THE CONTRIBUTION OF DAIRY CATTLE TO POVERTY REDUCTION IN IGUNGA DISTRICT OF TABORA REGION

BY

JOHN KANGALA MCHAGO MNGOFI

A DISSERTATION SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE OF MASTER OF ARTS IN RURAL DEVELOPMENT OF SOKOINE UNIVERSITY OF AGRICULTURE. MOROGORO, TANZANIA.

2009

ABSTRACT

This study was conducted to evaluate the contribution of dairy cattle to poverty reduction in Igunga District of Tabora region. The study focused on exploring milk marketing, determining dairy cattle performance, assessing different sources of income and assessing dairy-crop integration. Primary data were collected using a semi structured interviewing schedule from 51 dairy cattle owners, and 53 farmers without dairy cattle. The study was carried out using a cross sectional research design approach. Statistical package for social science (SPSS) computer software was used to analyze the data. The major occupation of respondents was farming, although some practiced petty trading and a few were civil servants. Dairying was practiced but not as the major economic activity. The mean income after joining dairy activities was found to be more than four times (Tshs 2 941 955/=) than the mean income before they practiced dairying (Tshs 629 959/=). A t-test computed revealed statistically significant difference between those incomes ($t = 1.936$; $p < 0.05$). Farmers saved an amount ranging from Tshs 168 000/= to Tshs 420 000/= used for buying mineral fertilizers through using cattle manure. Crop residues were used to feed dairy cattle. Lactation lengths were significantly correlated ($r = 0.385$; $p < 0.05$) with the amount of milk produced in a lactation. Major constraints encountered in dairy project in the study area included lack of enough pastures, drugs, water and animal diseases whereby 41 animals died and lack of reliable markets for their milk. The multiple correlation ($R = 0.861$) computed had shown that dairy farming was profitable and had contribution in increasing household income. For efficient breeding and improved dairy cattle production, dairy farmers in Igunga district should be educated to adhere to the principles of dairy cattle managements so as to benefit from the project. This study has indeed shown that dairy cattle enterprises had contribution

to poverty reduction through income obtained, milk consumed and increased crop yield after using cattle manure.

DECLARATION

I, John Kangala Mchago Mngofi do hereby declare to the Senate of Sokoine University of Agriculture that this dissertation is the result of my own original work and that it has not been nor concurrently being submitted for a higher degree award in any other University.

_____ _____

John Kangala Mchago Mngofi Date

(MA Rural Development Candidate)

The above declaration is confirmed

_____ _____

Prof. G. C. Kifaro Date

(Supervisor)

COPYRIGHT

ACKNOWLEDGEMENTS

I wish to express my deepest appreciation to all members of my family for their financial support which made this study possible.

I am very much grateful to my supervisor Professor G.C. Kifaro of the Department of Animal Science and Production (DASP), Sokoine University of Agriculture (SUA) for his valuable guidance, wisdom, encouragement, patience, ideas and constructive criticisms throughout this study. I am proud to have worked under him.

I also extend my gratitude to Igunga District Council for granting me a study leave. I appreciate DALDO'S office contribution and assistance rendered by Agriculture and Livestock staff from the initial stage in proposal development to data collection.

I also appreciate the assistance made by different staff from DASP, Sokoine National Agriculture Library (SNAL) and my colleagues during compilation to data analysis. I extend my thanks to all respondents who devoted their valuable time in ensuring that I obtain the necessary information for this study.

Last but not least, I would like to thank Mr. C.P. Shengena, J.P. Mndeme, my mother, relatives and friends, wife and my children for their encouragement and patience for the two years of my stay at the University.

DEDICATION

This dissertation is dedicated to my wife Monica Paschal Mngofi, my children Jane, Erick, Freddie, Vincent and George and lastly to my father the late Mzee Marcel Mchago, who passed away when pursuing my course work in July, 2007.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF APPENDICES

LIST OF ABBREVIATIONS

AFC	-	Age at First Calving
AI	-	Artificial Insemination
AIDS	-	Acquired Immunity Defficiency Syndrome
ASDP	-	Agricultural Sector Development Programme
CI	-	Calving Interval
CBO	-	Community Based Organization
DALDO	-	District Agriculture and Livestock Development Officer
DASP	-	Department of Animal Science and Production
DP	-	Dry Period
FFS	-	Farmers Field School
FMD	-	Foot and Mouth Disease
FAO	-	Food and Agriculture Organization
FBO	-	Faith Based Organization
GDP	-	Gross Domestic Product
HBS	-	Household Budget Survey
HIV	-	Human Immunodeficiency Virus
IGA’s	-	Income generating activities
IPM	-	Integrated Pest Management
LID	-	Livestock in Development
LL	-	Lactation Length
MAC	-	Ministry of Agriculture and Co-operatives
MDG	-	Millennium Development Goals
MLD	-	Ministry of Livestock Development

MKUKUTA	-	National Strategy for Growth and Reduction of Poverty
NGO	-	Non Governmental Organization
PADEP	-	Participatory Agriculture Development Programme
SNAL	-	Sokoine National Agricultural Library
SPSS	-	Statistical Package for Social Science
SUA	-	Sokoine University of Agriculture
TASAF	-	Tanzania Social Action Fund
TBD	-	Tick Borne Diseases
TDV	-	Tanzania Development Vision
URT	-	United Republic of Tanzania
UN	-	United Nations
US $	-	United States of America Dollar

CHAPTER ONE

1.0 INTRODUCTION

1.1 Background about Poverty

Poverty is defined as the lack of certain capabilities such as being unable to participate with dignity in the society. The definition was modified by Amalu (2005) as a living standard condition in which an entity is faced with economic, social, political, cultural and environmental deprivations faced with vulnerability (high risks and low capacity to cope) and powerlessness. Furthermore, poverty may also be defined as a state of deprivation and prohibitive of decent life, since it is a result of many and often mutually reinforcing factors, including lack of productive resources to generate material wealth, illiteracy, prevalence of diseases, discriminative, socio-economic and political systems and natural calamities such as drought, flood, HIV/AIDS and wars (URT, 2005).

As summarized by World Bank (2001), poor people are those who lack adequate food, shelter, education, health and have deprivations that keep them from leading a kind of life that every one values. Poverty has been viewed as a situation whereby anybody lives on an income or expenditure of less than US $1 per day (URT, 2001). Poverty definitions fall under two main categories namely relative and absolute poverty. The relative poverty approach focuses on the relative well-being of a proportion of the population with respect to the welfare distribution of the entire society. The absolute poverty approach focuses on the inability of a person to attain a specified standard of living in isolation of the welfare distribution of the society (Jambia *et al.*, 1997).

Different efforts have been made by the government on issues pertaining to poverty reduction. Among such efforts include adoption of the Tanzania Development Vision (TDV)-2025 (URT, 2001) which provides broad guidance on the strategic goals of social and economic development in the country. The TDV looks broadly forward in raising general standard of living of Tanzanians to the level of typical medium income developing country by 2025 in terms of human development. Priority goals are ensuring basic food security, improving income level and increasing export earnings. With support from development partners, the government has initiated a national strategic policy framework aimed at progressively achieving the vision's goal in the country.

Although the Government has a primary role in provision of reliable environments for poverty eradication, every individual is obliged to work hard since it is one's responsibility to work for betterment of his/her family. Alternatively, development partners like Non Government Organizations (NGO), Community Based organizations (CBO), and Faith Based Organizations (FBO) have implemented various initiatives aimed at eradicating poverty in various sectors. One of the FBO is the Moravian Church (Western Zone) based in Tabora, which is working with other stakeholders and the government to improve the welfare of rural people. One of the areas was the provision of dairy heifers to women from poor families in Igunga district.

Tanzania having a large cattle population of about 18.5 milion (MLD, 2006), has a great milk production potential. However, like many other developing countries, Tanzania has a large and growing deficit in milk and milk products to the extent that it imports substantial amounts of dairy products (Kurwijila**,** 2002). The dairy industry in Tanzania is dominated by the traditional sector such that milk production is only the second reason for keeping

livestock. It is estimated that 67% of milk consumed in Tanzania comes from this sector (MLD, 2006). Livestock in Igunga district is faced by many constraints including keeping of large numbers of animals but having little or no attention on milk production. Also, a large number of livestock keepers prefer large herds of animals for prestige together with other socio-economic factors, putting little attention on grazing land and supplementary feeding. Their productivity is relatively small and the market is not well developed as it involves traditional herds which have low production efficiency. Although this herd is based on partial suckling process, the milk production doesn't exceed 2 litres per day. This means traditional cattle in Igunga district are more of a social investment.

1.2 Problem Statement

Apart from being endowed with many natural resources including large numbers of livestock (ranks first in Tabora Region), Igunga District is one of the poorest districts in the region. The situation is indicated by people living in poor houses, low per capita income of Tshs 119 000/= (URT, 2006c), poor access to health facilities and relatively low gross enrolment to both primary and secondary schools. One of the reasons causing such situation is likely to be lack of capital to purchase dairy cattle and little knowledge on how to initiate dairy enterprises. It is hypothesized that those farmers who were given dairy cattle 12 years ago are not economically better off compared with those with none.

1.3 Justification

People in the study area are still poor. They have indigenous cattle which contribute little in poverty reduction. The solution was to introduce activities which could generate income. And since those activities were not available, dairying was introduced to serve the purpose. The study to compare income levels among dairy cattle owners and non dairy

cattle owners was a worth undertaking to reveal the role of dairy farming to poverty reduction. This study was in line with Millennium Development Goals (MDG) No 1 which calls for a reduction of poverty by 50% of the people with income of less than 1US$ per day, The National Strategy for Growth and Reduction of Poverty (MKUKUTA), stipulates in cluster 1 for increased growth rate of livestock sub sector from 2.7% in 2000/01 to 9% by 2010 (URT, 2005). Furthermore, the results might be useful to various stakeholders including farmers and NGO's for giving more emphasis on dairy farming for poverty reduction.

1.4 Objectives

The general objective of this study was to determine the contribution of smallholder dairy cattle enterprises in poverty reduction in Igunga district, Tabora region. The specific objectives of this study were

(a) To identify major sources of income for households.

(b) To compare levels of poverty between people owning dairy cattle and those without dairy cattle in the study area.

(c) To evaluated performance of dairy cattle, together with exploring market availability of milk in the area.

(d) To explore the existence of dairy - crop integration in the study area.

1.5 Hypotheses

1.5.1 Null Hypothesis

Dairy cattle production in Igunga has no impact on poverty reduction.

1.5.2 Alternative Hypothesis

Dairy cattle production in Igunga has an impact on poverty reduction.

CHAPTER TWO

2.0 LITERATURE REVIEW

2.1 An Overview of Poverty

Poverty may be regarded as a situation of lack of sufficient means or income for a minimum level of living: food, shelter, clothing, a job, a piece of land to till, vulnerability to changing economic and natural conditions (Jambia *et al.,* 1997). The rich countries perceive poverty as deprivation of materials for well being. However, the poor countries perceive poverty as a multidimensional social phenomenon; ranging from food and material deprivation to the psychological experience of multiple deprivations (World Bank, 2001 as cited by Kitalyi *et al.,* 2005). In the social context, poverty means lack of a wider array of human non-material needs such as rights of /or access to community or state-provided goods, freedom and respect. Thus, poverty goes beyond lack of material requirements. Rural poverty is commonly presumed to be more pronounced in marginal than in favoured production environments, either in terms of the number of poor people or the proportion of the population that is impoverished (Renkow, 2000).

Poverty is more severe in rural areas compared to urban areas. Indeed among total poor population, the urban poor constitute about 13% compared to 87% in the rural areas (URT, 2003). However, Minot (2007) found little evidence that remote rural areas are left behind either in relative or absolute terms. Most of the initiatives for poverty reduction in Tanzania take various forms of interventions by the Government, donors and NGO's movements. Such interventions are mainly engaged in supporting specific income generating activities (IGA's) (Mtatifikolo and Mabele, 1999).

More than 91% of the total population of Igunga depend on agricultural activities, livestock and natural resources for their livelihood with an average of 6.2 people occupying one household (URT, 2007).

2.2 Importance of Smallholder Dairy Farming

The smallholder dairy enterprises emerged in Tanzania in 1980s in an attempt to contribute to the milk supply after parastatal farms failed to meet the consumers demand (Ministry of Agriculture 1997; Sumberg, 1997, as cited by Mdegela *et al.,* 2002). The sector contributes significantly to poverty alleviation and reduction of malnutrition particularly in rural and peri- urban areas. In Tanzania, farmers consider this industry as their main source of income. However, despite the important role of the industry farmers have experienced sub optimal performance of their animals. For example, in Southern Highlands of Tanzania the average milk yield per cow was found to be 5.7 litres per day Bayer *et al.* (2006)**,** such a low milk yield is attributed to many factors including poor animal management and diseases.

Although smallholders own more than 80% of national cattle herd, Mchau (1991) reported their contribution to the national dairy industry has been proportionately low, largely due to low productivity of indigenous breeds and hostile production environments. Because of the large number of people and cattle involved in the smallholder sector, government and aid organizations have started to promote small-scale dairying as a powerful means of rural development and of meeting the national demand for milk. Lyimo (2006) noted that smallholder dairy farming community is basically an agricultural community characterized by low capital investment whereby milk is considered as the main product from the enterprises.

Apart from other benefits obtained from dairy cattle; broadly a dairy cow is expected to produce milk and sold for slaughter when she becomes too old to produce milk. Feeding is haphazard and management is poor. Animals are grazed or browse on green vegetation during rain season, but in the dry season they are fed cut forages and crop residues.

2.3 Different Sources of Income

2.3.1 Agriculture

Agriculture (farming activities) is the predominant occupation in most of rural areas in developing countries. The economies of almost all the developing countries are dominated by agricultural sector. Leather and Foster (2005) viewed agricultural activities as one of the stimulant to economic growth, increased farm employment and increased quantity of food supply. Koda and Mukangara (1997) found that high incidences of poverty in rural areas were associated with the constraints in agricultural sector, whereas small scale subsistence farming is predominant. In 2005, the contribution of agricultural sector to the national Gross Domestic Product (GDP) was 45.6%; livestock 5.9%; fisheries 3.0%; and forestry and hunting 2.7% (Economic survey, 2005 as cited by URT; 2006a), out of this crop production contributed 34.0%.

2.3.2 Small animals

In low rainfall areas of much of Africa and Asia, small ruminants represent the principal economic output contributing a large share of the income of farmers. These animals often depend on low quality crop residues, like maize straw stubbles and inexpensive food supplements (Salem and Smith, 2008). Advantages of co- grazing of sheep and goats are derived primarily from differences in preferences for particular plant species and parts; ability or willingness to consume forages that are not highly preferred and would have

greater adverse effects on the other species and physical capabilities to gain access to specific types of vegetation (Animut and Goetsch, 2008).

Poultry production system in Kusa community of Kenya was reported to supply many households with increased food nutrition and income security (Acamovic *et al.,* 2005). According to these authors, demand for eggs was growing very rapidly as more households learn of the importance of protein-rich diets especially for those suffering with HIV/AIDS related diseases. Peacock *et al.* (2005) reported that during severe drought of year 1999 to 2000 in Ethiopia, when one goat was sold it provided an income enough to buy grains to feed the family of five for 2 to 3 months.

2.3.3 Off-farm employment

Off-farm employment is an additional source of income for large groups of farmers (Tabatabai *et al.,* 1984). In most cases one or two family members work part or full time, run a small enterprise or are employed in administration sector. Obviously the income obtained from farming activities is not sufficient to cover all the needs of small farm households. Hence, off-farming employment is one of the few opportunities to earn some cash, considering the majority of the small farms are subsistence with not much surplus left to be sold on the local market.

Non-farm income appears to offer an important route out of poverty (Lanjouw *et al.,* 2001). The deployment of farm household labour is receiving increased attention due to increase in economic constraints in rural livelihood. There is a growing recognition of the importance of non-agricultural income in rural households. In a recent study of a village in Morogoro, Tanzania, it was found that approximately half of households' incomes came

from sources other than agricultural production (Tripp, 2006). Agriculture in Botswana is centred on small, mixed livestock-crop farming system. Cattle are the backbone of the farming economy, contributing milk for home consumption and cash through sale of milk (Chambers, 1989). Different activities are performed to cater for daily needs in terms of cash earnings. Among the most common ones as pointed by Chambers (1986) are growing of subsistence crops and vegetables on whatever land can be found, casual labour during agricultural season, domestic works, and odd jobs, temporary employment on public works, fishing, hunting, gathering of wild fruits, gleaning, and scavenging. According to the same author other activities include keeping of small stock either for others or on their own account-goats, sheep, pigs, hens, ducks, pigeons, turkeys, rabbits, beekeeping, using their own or a borrowed or a hired mule, donkey, camel, bullock, a cart bicycle (rickshaw), bicycle, or a handcart to transport people, crops and vegetables. Furthermore, Chambers (1986) indicated that fishing, collection of commercial insects, fruits and plants, medicinal herbs and roots, grass for thatching, wood for fuel or building and selling charcoal, twine, leather goods, nets, mats, bricks, pots, tiles, petty hawking, craftwork, blacksmithing, carpentry, building, thatching, begging and theft are also activities performed for income earnings. Gueye (2003) pointed out that although requiring low level of input, family poultry contribute significantly to food security, poverty alleviation and ecologically sound through droppings as they can be used as fertilizer.

2.4 Major Purposes of Dairy Production

In most of developing countries, dairy cattle represent an important segment of livestock economy. Milk consumption in Tanzania is estimated at forty litres/capita/year, below world recommendation of 200 litres (MLD, 2006) while Kenyan milk consumption was reported by Smallholder Dairy Project (SDP) (2007) to be 145 litres per person per year,

making Kenya among the highest milk consumers in the developing countries. However, as noted by Kurwijila (2002), milk consumption is increasing faster in urban and peri-urban areas of Tanzania than in rural areas, and this is evidenced by the growing of peri-urban dairy herds and the increased availability of milk and dairy products to urban dwellers. The reasons for raising dairy cattle in urban areas were to earn money since the resources encourage urban dwellers to undertake animal agriculture. In Dar-es-Salaam for example, Mlozi (2001) reported that the dairy cattle herd increased from about 2 000 herds in 1984 to over 20 000 herds by 1995. The dung produced by cattle helps to improve soil fertility. For years dairying has been one of the most profitable and widespread farming system (Haines, 1982). In one study carried out by Bayer *et al*. (2006) through Caritas in Mbeya Tanzania, it was observed that income from milk sales helped the smallholder families to acquire additional land, improve their houses (including cattle sheds), finance small scale business, send children to secondary schools and expand the dairy business. Manure helped to double the maize yield and improve yields of other cash crops, such as tomatoes and bananas. Families that barely managed to survive some few years back were now considered wealthy. Improving productivity of dairy animals in the smallholder sector is crucial for increased output and family welfare. Improved management in terms of feeding and disease control is essential for productivity improvement (Urassa and Raphael, 2006). Heffernan *et al.* (2005) showed that livestock were largely associated with security and wealth accumulation. Indeed, animal ownership had a protective function in preventing households from participating in activities associated with extreme poverty such as begging.

2.5 Livestock, Economic Development and Poverty Alleviation

As noted by Food and Agriculture Organization (FAO) (2003), the livestock sector presents a major opportunity to enhance the livelihood of a large portion of the worlds poor.

Livestock ownership currently supports and sustains the livelihood of an estimated 675 million rural poor people. They depend on livestock fully or partially for income and subsistence. The smallholder dairy production in Kenya represents the fastest growing sources of farm income, benefiting more than half a million households, which each earn more than US$ 300 annually on average from dairying (Haggblade *et al.*, 2004). Livestock can provide a steady stream of food and income and help to raise whole farm activities. They are often the only livelihood option available to the landless. Furthermore, livestock are often the only means of asset accumulation and risk diversification that can prevent the rural poor in marginal areas from sliding into poverty. As noted by Livestock in Development (LID) (1999) and cited by Perry *et al*. (2005), it is estimated that livestock form a component of the livelihood of 70% of the world resource poor, something that many people living in the developed world have great difficult to understand. Income from milk sales is of particular value as it is generated daily and more likely to be used for increased family well being than the periodic incomes derived from other agricultural activities (Berry, 1985).

Livestock are kept mainly for their products as well as their by-products. In referring to Ardakan and Emadi (2004), livestock products and by-products such as bone, horn and manure are important for improving their crops, minimize wastes and reduce the annual external inputs they require. They conceived that bones have an important role to play in improving the fertility of the soil. Apart from Iranian villages utilizing animal manure as a source of energy, burning of animal manure is believed to protect fruit trees from cold. They also pointed out that horns and the clippings from animal hooves have been used to fertilize the soil, and the smoke created by burning mixture of horns and cow dung is regarded as an effective way of controlling pests such as locusts.

2.6 Livelihood of Rural Individuals and Non-Farm Enterprises

Livelihoods of individuals demand several things which have to be worked out to ensure their survival. There are different activities which play important roles in increasing income of people and thus reduce poverty. On-farm enterprises or micro enterprises form part of rural informal sector. Seppala (1996) described informal sector as an enterprise which employs people who are operating informally. These activities (performed by micro enterprises) are taken by all household heads or some of the members of the household or all household members in collaboration with another household. In Tanzania, there is a wide range of non-farm activities, including food selling, preparation and selling of local beer, tailoring, petty trading, pottery, charcoal or firewood selling, fishing, gardening, masonry, carpentry and many more. Developments of these enterprises in Tanzania are important since they are the alternative sources of income together with supplementing low incomes from agricultural production. Apart from generating income, non-farm enterprises create employment opportunity together with production of locally needed materials. The dairy sub- sector plays a crucial role in sustaining smallholder crop and dairy systems through nutrient cycles. It plays a role in sustaining human population densities even in semi arid areas. It is an important tool in reducing poverty in rural and peri-urban areas. Muriuki *et al.* (2001) pointed out that crop/dairy systems support three quarters of Kenya's rural population which is the largest dairy sub-sector and with highest per capita milk available in sub Saharan Africa. Thus the dairy sub-sector contributes directly through milk consumption as well as income generation through selling of milk. Akter *et al.* (2007) underlined that livestock act as a very real means of smoothing income by allowing debts to be repaid, farm inputs and medical treatment to be purchased and dowry to be paid.

2.7 Importance of Agriculture in Rural Poverty Reduction

Agriculture remains the largest sector in the economy and hence its performance has a significant effect on output and corresponding income and poverty levels. The sector accounts for about half (46.2%) of GDP and about 50% of export, and sale of agriculture products accounts for about 70% of rural household income (URT, (2006 b). Agriculture is important to Tanzania's economy and social development for several reasons. According to the (1991/92) Household Budget Survey (HBS) in Tanzania as indicated by URT (2001), about 50% of Tanzanians are defined as poor, meaning that they have a per capita income of less than 1 US$ per day. The studies (HBS 1991/92) also found that over 80 % of the poor are in rural areas depending on agriculture for their livelihood. This implies that improvement in farm incomes of the majority of the rural population is a precondition for reduction of poverty. Secondly, food insecurity is the manifestation of poverty. It is estimated that around 42% of the households regularly have inadequate food (URT, 2001). Those food price fluctuations put the poor producers and consumers in a more precarious condition. Thirdly, agriculture has for a long time became the largest contributor to GDP as well as foreign currency earnings, although this sector is now preceded by tourism, mining sector and communication. Long (1977) stated that one of the tools in improving rural development was to increase agricultural production through application of scientific knowledge and capital investment; and this is to be achieved mainly through increased extension services among the peasant farming population. World Bank (2001) added that agricultural growth linkages in Tanzania were higher than those of other sectors, in both rural and urban areas. Therefore, agricultural development is the key to the country's overall economic development now and in the near future.

2.8 Problems of Marketing Livestock Products

General factors which contribute to problems in marketing include the nature of the agricultural commodities and the way in which the small-scale producers are distributed. Furthermore, agricultural productions take place in poorly developed rural areas. The perishability of milk products results in wastage on transit, as fresh milk requires special containers and refrigerators to ensure that quality is maintained. All these, tend to raise the handling costs of the commodity**.** Upton *et al.* (2005) indicated that since there is a growing urban population and increasing per capita income, the main markets for livestock products exist in towns and cities. The remoteness of many livestock producers from these markets creates physical problems of access. As a result rural poverty is often worse in remote regions of developing countries. Livestock producers in remote areas are facing serious disadvantages in seeking markets and they have little knowledge and information on market opportunities as well as price prevailing in the large urban markets. When the farm products are ready for the market, the problem for most small farmers are when, where and how to sell the products (Yoshida, 1999).

2.9 Access to Milk Marketing

The number and type of markets available in a given area are determined by the density of the population in the area, the quantity of milk produced, and the cost of transporting the dairy products. Consequently, the profit from dairy production is determined by the cost of production and by the selling price. The dairy products are produced at such a time that the consumer market will absorb them at a reasonably high price. The marketing structure is privately run when a farmer secures his own market and sells straight to his own consumers. In Igunga district, milk production drops in the dry season. The milk produced does not satisfy district requirements although in rural areas the price of milk drops to Tshs

250/=per litre of milk (IDC, 2007). Successful operations of the small-scale dairy enterprises are dependent upon the income from the milk sold, particularly when dairying is the major enterprise. Different localities have different ways of disposing milk available. A milk producer must make a careful analysis of the markets available in his own community and calculate probable income from the commodity in hand. The largest market for milk in Igunga district is milk for consumption and mainly the milk is delivered from producers direct to consumers. This is referred to as producer-distributor system. This implies that milk distribution is a business by itself (Reaves, 1963).

2.10 Dairy Cattle Performance

Dairy cattle performance implies how well or bad the dairy cattle can produce milk through observing important traits associated with animals which are vital for the economic sustainability of a dairy farm. Milk production varies with breed, age, stage of lactation, nutrients intake in the late stages of pregnancy together with water availability (McDonald *et al.,* 2002). Among the important indicators related to smallholder dairy production includes age at first calving (AFC), lactation length (LL), calving interval (CI) and calf mortality (CM). Age at first calving (AFC) is defined as the period in days or months from birth date to first calving date. Early AFC is an important desirable economic character of dairy cows since it increases the margin of profit by increasing lifetime production and reducing the generation interval. Cows calving at an early age give more number of calves and thus more lactations are obtained in a cow's lifetime. Referring to Luoga (2005), under good management and good access to nutrition a heifer can be bred at 18 months of age. Mchau (1991) pointed out that the reduction in the age at first calving and dry period leads to an increase in lactation yield and productive life of the dairy animals and economic situation of a dairy farm. According to Mchau (1991) AFC in cross

bred heifers was mostly observed to be in a range of 27 to 37 months. Bebe *et al.* (2008) when studying on feeding and practices for intensified smallholder dairy system in Kenya Highlands, found the mean AFC to be 32 months. Recommendations by Roberts (1986) revealed that the age at first mating should range from 14 to 22 months with an average gestation length of 9.3 months (275 to 287 days). Van Dam *et al.* (2006) observed that AFC was not significantly related to either milk production or reproduction efficiency. In one study in an Ethiopian Ranch, Dekeba *et al.* (2006) reported a delayed AFC of 54 months and related it to inefficiency in production of in-calf crossbred heifers.

Calving interval (CI) can be defined as the period between consecutive calvings, and can be expressed in days or months. The importance of calving interval as one of the dairy performance parameter is because the length of the CI is often used as a measure of reproductive performance. Long CI results in more milk per lactation although fewer calves are born each year for herd replacement. CI differs between dairy cows mainly due to different management practices. Furthermore, too long CI reduces the number of calves that will be produced in a lifetime of the dam (Mahadevan and Hutchson, 1964). Milk production in pastoralists' society is marked by a strong seasonal influence on yield and composition. Because of low nutritional levels, yields tend to be low and a significant part of the yield is taken for human use. Poor nutritional status is therefore thought to be the main cause of delayed age at maturity and first calving (Nicholson, 1985). However, the results from this study were very far and beyond the optimal range stated by different authors as follows: Wilson (1998) reported that there is an ideal calving interval normally taken as 365 days in the case of cattle, but under certain circumstances there may be good management reasons for making the interval shorter or longer than normal. The results from this study revealed longer CI, and this is probably the reason why the study area still

has relatively few dairy cattle than if CI could be at its optimal stage. Mc Donald *et al*. (2002) observed that in situation of food scarcity, as with cattle kept on natural pastures and subjected to drought, in such situation it is common to find CI's extended from the desired 12 months to as much as 24 months. The CI in tropical countries ranges between 375 to 390 days (Wattiaux, 2004).

Moreover, some studies have reported higher CI than that observed in this study. Dekeba *et al.* (2006) reported a longer CI of 534.3 days in an Ethiopian Ranch. Gimbi (2006) reported CI of 526 days which was higher than that observed in this study of 491 days; Mureda *et al.* (2007) reported a relatively higher CI of 534 days in Eastern lowlands of Ethiopia. Mismanagement practices like poor heat detection and feeding could be the cause of long CI reported in this study.

In one study in Kenya, Mwangi *et al.* (2005) noted that a general feature on all smallholder dairy farms is the low growth rate of replacement heifers, and that on most farms, weight gains are below 200g/day between birth and weaning. This results in heifers calving at over 3 years of age. Calf mortality is high at over 20% on smallholder farms. Calf deaths represent a direct loss from sales of calves and also milk from cows.

2.11 Access to Extension Services

Extension services are among other factors that influence livestock production. Extension services carry technical information from policy makers, researchers and extension agents to livestock keepers; and at the same time the information flow from farmers back to the source is through extension services. Apart from assisting livestock keepers to increase livestock production and productivity, extension services contribute to household food

security (Mngulwi *et al.,* 2004). Furthermore extension services help livestock keepers to identify problems related to their livestock production and make decisions towards sustainable livestock production. The role of extension services in agricultural and livestock development involves improvement in the performance of those involved in primary production. Higher levels of production efficiency in provision of goods and services are attempted in order to increase their per capita income, quality of life and general welfare. An extension officer can assist farmers by increasing awareness of improved technologies as well as improving decision making skills.

2.12 Dairy -Crop Integration

Cattle manure is important in crop production. In Kenya, Stotz (1979) noted that one of the main objectives for adopting zero grazing was for the production of manure for coffee production. Similarly, the author reported that in Tanzania and Malawi the value of manure as fertilizers has been appreciated by farmers. Collection and use of farm yard manure has been and continuous to be a very important point stressed in extension programme in the study area. However, the rate of adoption of that technique by farmers is relatively low as they claim that their farms still have natural fertility. In some areas where farm size has declined in Kenya, cattle manure is collected from livestock pens and applied to fields to improve fertility and increase yield (Bourn *et al.,* 2005).

CHAPTER THREE

3.0 MATERIALS AND METHODS

3.1 The Study Area

This research was conducted in Manonga and Igunga divisions of Igunga District, in Tabora region in the Western part of Tanzania. The district is situated between latitudes 3°and 4° South of Equator, and longitudes 33° and 34° East of Greenwich, and has a population of 383 622 people (IDC, 2006). The district which is divided into four divisions, twenty six wards and ninety six villages, covers an area of 4 499 km^2 of which 3 145 km^2 (69.9%) is arable land. However, the land under cultivation is only 906 km^2, (about 29.0% of the arable land). Forest reserves cover 125 km^2 and residential areas, roads, and rivers cover 229 km^2. According to livestock census which was conducted in 2003, the district has the largest livestock population compared to other districts of Tabora Region (i.e. 466 892 cattle which was 29.8% of the total cattle in the region, 234 077 goats which was 32.6% of all goats in the region and 101 570 43.2% of total sheep in Tabora region (URT, 2007 b).

3.2 Background of the Project

Dairy development activities started in Igunga district since 1996, and were targeted to women who were in need and could not afford to purchase cows by their own means. Initially the community was involved in project planning and was planned as the medium term. The project objectives were to provide farmers with improved dairy cows improve family nutritional status and increase income through sale of milk. The priorities were to increase family income, provision of farm manure and provision of skills in appropriate dairy cow management. The project operated on the “take a heifer and return the first

female offspring to the project" basis (heifer in trust). The heifers provided were F1 (Friesian X Boran crosses) and F2 crosses which were genetically improved to enable the families with low income to get a relatively high amount of milk and income through sales of milk. Certain qualifications were to be met by those farmers, including being financially able to construct a zero grazing shed for dairy cattle, together with attending a basic dairy cattle husbandry course for four days. The beneficiaries were also told to sign an agreement with their sponsor (Moravian Church) to return the first heifer, which would be provided to another individual under the same conditions. Initially, the project started with 12 in-calf heifers which were distributed to beneficiaries as follows: Igunga-7, Mwanzugi-3, Nyandekwa-1, and 1 at Nkinga villages. Currently, the project has more than 150 animals, with 70 beneficiaries while the aggregate district dairy cattle population is more than 200 owned by individuals (UTR, 2007a).

3.3 Research Design

Four villages namely Igunga, Mwanzugi, Nyandekwa and Nkinga were selected because they were supported by Moravian Church. This study was carried out using a cross sectional research approach, which is most common in survey research as it makes possible the collection of data at a single point in time. According to Babbie (1994) this approach is suitable for a descriptive study, determination of relationship between and among variables, using interviewing schedule and checklists since it requires minimum time and resources. The study was also supplemented by observations on the farmers and discussions with officials in the District Agricultural and Livestock Development Office and the former project coordinator.

3.4 Sample Size and Sampling Techniques

This study constituted fifty one small scale dairy farmers, and fifty three individuals who did not practice dairy farming at the time of study. Purposive sampling was done to select dairy cattle owners, since the interest of this study was to select only dairy cattle owners on one side, but for non dairy cattle owners' random sampling was conducted. The interview schedule was composed of closed and open ended questions (Appendix 1 and 2) which were used to obtain primary data from both groups of respondents. The third questionnaire (Appendix 3), in a form of a checklist was used to acquire information from the former Director of Igunga Heifer Project, District Planning Officer, Project Advisor and two members of the project committee. Pre-testing of the questionnaire was done prior to data collection whereby eight dairy cattle owners and five non dairy cattle owners were involved in Igunga and Mwanzugi villages.

3.5 Data Processing and Analysis

After the interviews, responses on each questionnaire were inspected for their accuracy immediately before proceeding to other respondents. The compiled interview schedules were then summarized, coded and entered into a computer and then analyzed using Statistical Package for Social Science (SPSS) computer programme. Descriptive statistics were computed and used as an initial step to determine individual factors affecting poverty in the households for both dairy and non dairy cattle owners. Bivariate analysis (t-test) was computed to determine whether there were differences and/or similarities in means of some variables among different groups of respondents. The study was further supplemented by personal communication with respondents and discussions with officials like the former project coordinator and at District Agricultural and Livestock Development Officer (DALDO). Further analysis was carried out since it was useful to find the influence of

independent variables on total annual household income. Linear multiple regression was employed to determine the effects of various independent variables on the dependent variable. That is to determine the influence of independent variables on the reduction of poverty level among dairy cattle owners. The independent variables entered into the model were incomes from agricultural activities, dairying and small enterprises.

The model was specified as follows:

$$Y = a + ß_1X_1 + ß_2X_2 + ß_3X_3 + e$$

Whereby,

Y	=	**Total annual household income**
a	=	**Intercept of the equation (constant term)**
$ß_1$, $ß_2$, and $ß_3$,	=	**Regression coefficients for independent variables incomes from agriculture, dairying and small enterprises).**
X_1	=	**Income from agricultural activities**
X_2	=	**Income from dairying**
X_3	=	**Income from small enterprises**
e	=	**random error term**

Other independent variables (kiosk owning, employment, gardening, casual labour, oxenization and animal keeping were not included in this model because they have many missing values and this is the limitation adopted in computing this regression.

CHAPTER FOUR

4.0 RESULTS AND DISCUSSION

4.1 Household Characteristics

4.1.1 Household size

It has been revealed that the area under study has a relatively high household size with an average of 6.8 and 5.7 people for dairy and non-dairy cattle owners respectively. The minimum and the maximum household size of dairy cattle owners were 2 and 16 people respectively. Moreover, the minimum and the maximum household size of non- dairy cattle owners were one person and 12 people respectively as Table 1 depicts. The total number of households in the district was 56 191 for 2007/08, and the average household size in the district is 6.2 persons (IDC, 2007). Household size influences labour availability for crop production together with dairy farming activities. This is because both activities are labour demanding.

The household members are the main source of labour power for different activities in the study area and other different areas. Hence households with one or two members are said to have little labour power and consequently they would not be able to keep dairy cattle and perform other activities like agriculture which require much labour. According to findings by Rodgers (1989), rich households have more members than poor ones. Large size households are not always associated with poverty because sometimes the presence of more members in a household implies better socio- economic status which tends to attract more relatives and non relatives to that household. This study has observed that richness of a household is judged according to the number of children they have, number of animals, assets and resources like ox-carts, large farmland and many members who would cultivate that land.

Table 1: Household size of the respondents

Respondents	N	Minimum	Maximum	Mean
Dairy cattle owners	51	2	16	6.8
Non dairy cattle owners	53	1	12	5.7

4.1.2 Education level of the respondents

Half of the dairy cattle owners (51%) had primary school education and about a quarter (25%) had secondary education. About 7.8% never attended formal education. On the side of non- dairy cattle owners, 67.9% had completed primary education, while 15% had secondary education and 17% had never attended formal education as indicated in Table 2. Farmer's education is very important for their ability to understand and utilize efficiently the advice and information offered by the extension officers and development agencies (Ragnard *et al.*, 2002).

According to Lyimo (2006), primary education could be regarded as a fair level for dairy farmers, since such level of education makes it easy for adoption, development and administering of technologies. This means literacy level allows such farmers to properly understand and follow-up extension packages aimed at managing dairy cattle as well as other agricultural practices.

The results imply that the majority of respondents are having the basic education in acquiring knowledge, skills and attitude change to solve technical problems associated with managements of dairy farming. Levinger and Drahman (1980) as cited by Mchomvu (2002) noted that poor and less educated people generally lack confidence in their ability to improve their lives. Generally it can be said that, people's level of education has a positive relationship with their level of participation in all stages during initiation, to the implementation of development activities. However, sub-standard management of dairy

cows was observed like lack of tick control through weekly dipping as well as other disease control measures like vaccinations. The sub standard management of dairy cattle observed was because it is a new enterprise and also the training was too short (only four days). It was observed that some farmers who were trained were the owners of dairy cattle but were not practicing the recommended practices of dairy cattle husbandry. Hence to achieve better management of this new enterprise frequent follow ups were required.

4.1.3 Occupation of respondents

The predominant occupation of the respondents in the study area was farming and some were engaged in off farming activities. It has been observed that 68.6% and 67.9% of respondents were performing farming activities as their major economic activities for dairy cattle and non dairy cattle respondents respectively as shown in Table 2. Sorghum and maize were mainly grown as food crops; cotton is grown for commercial purposes, while paddy is grown as a cash and food crop. Other crops grown in the study area include pulses and horticultural crops**.** Hayan–Malambo (1998) and Muriuki *et al.* (2001) noted that there were situations whereby dairy activities were given a second or third priority to farming activities and this might lead to poor management of dairy cattle like cleaning of cow's shade and tick control through dipping as were observed in the study area.

Survey results also indicated that about 13.7% and 13.2% of dairy cattle and non dairy cattle owners respectively, were civil servants. Income obtained from employment can be used to purchase inputs for improving dairy activities like drugs, feeds and paying veterinary services, as explained by some of the respondents. Furthermore, the income can be used to purchase fertilizers, herbicides and paying labour for various farm operations like transplanting, weeding and harvesting.

4.1.4 Marital status of the respondents

It was revealed that 86.3% of the interviewed dairy cattle owners' households were married, and 77.4% of non dairy cattle owners were also married as indicated in Table 2. Married couples are likely to be more productive than single persons due to labour supply and can share responsibilities in farming, managing dairy activities and reduce the burden on one person. Likewise, married couples have better access to productive resources in agriculture and dairy activities than individuals. According to Mtama (1997) as cited by Mwatawala (2006) marriage has an effect on the production process as it increases labour availability in the households.

In female headed households particularly in the absence of male head due to divorce or death, single parent unit women have no choice but to do all tasks including traditional male roles. Sigot *et al.* (1995) in Katheera Kenya found that women did all the tasks like land clearing which is traditionally a male role. Abel (2000) also found that in some of polygamous families in which men could not offer sufficient labour, women did all the tasks.

Table 2: Percentage distribution of education level, occupation and marital status of dairy cattle and non-dairy cattle owners (n=51)

Variables	Dairy cattle owners		Non- dairy cattle owners	
	Frequency	Percentage	Frequency	**Percentage**
Education level				
Non formal	4	7.8	9	**17.0**
Primary education	26	51.0	36	**67.9**
Secondary school	13	25.5	8	**15.1**
Adult education	5	9.8	0	**0.0**
Post secondary	1	2.0	0	**0.0**

education				
College/ University	2	3.9	0	**0.0**
Total	**51**	**100.0**	**53**	**100.0**
Occupation of household				
Farming activities	35	68.6	36	**67.9**
Civil services	7	13.7	7	**13.2**
Privately employed	1	2.0	1	**1.9**
Petty trades	3	5.9	5	**9.4**
Livestock keeping	4	7.8	0	**0.0**
Housewife	1	2.0	0	**0.0**
Businessmen	0	0	4	**7.0**
Total	**51**	**100.0**	**53**	**100.0**
Marital status				
Single	7	13.7	9	**17.0**
Married	44	86.3	41	**77.4**
Divorced	0	0.00	3	**5.7**
Total	**51**	**100.0**	**53**	**100.0**

4.1.5 Sex of respondents

About 55 percent of dairy cattle owners interviewed were females and 45 percent were males. Although the dairy heifer project was directed to women, it was difficult to obtain all women as respondents in this study partly because of death of the former owners and some had travelled. The results imply that although dairy activities were targeted to women, but now men have realized the importance of dairy cattle in poverty reduction in the study area. Likewise, it was observed that some female respondents felt shy to talk in front of people who were not familiar to them because of their traditions and other respondents felt shy since they failed to communicate in the national language. Although randomly selected, about half of non-dairy cattle owner respondents were males (49.1%) as shown in Table 3.

4.1.6 Age categories of respondents

The study revealed that 70.6% of dairy cattle respondents and 60.3% of non dairy cattle respondents were above 35 years of age (Table 3). The remaining for both categories had less than 35 years of age, whom were found to depend on their parents for their livelihood. It was also noticed in this study that there were no identified tasks for each age group. It is common for most African countries to pass their traditional ways of living to grown up persons. Respondents were asked how dairy activities would be sustained, they answered that dairy cattle farming would be imitated by their children.

4.1.7 Type of house (s)/ structures owned by households

In this study a modern house/structure was considered the one with walls built with cement bricks or burnt bricks and roofed with corrugated iron sheets. Houses built with mud bricks and corrugated iron sheet were termed improved ones, while poor houses /structures

were those made up of mud bricks or poles, thatched with grass, mud topped or without roof.

Table 3 shows how houses were built including the main house, kitchen and toilet. More than half (56.6%) of dairy cattle owners had modern main houses, while 47.6% of non-dairy cattle farmers also had modern houses. Results further indicated that 18.9% of farmers without dairy cattle owned poor houses as compared to only 3.9% of dairy cattle owners. About 36% of dairy cattle farmers had modern kitchens, while only 18.9% of those without cattle had modern kitchens. There were no households without a kitchen among dairy farmers while 11.3% of non dairy cattle farmers had no kitchen, meaning they used to cook on open space. About 30.2% of non-dairy farmers owned poor kitchen, compared to only 22% of dairy cattle owners.

Surprisingly, around one fifth (18.9%) of non-dairy cattle farmers had poor toilets as compared to only 3.9% of dairy cattle owners who did not possess toilets. The main reason is probably due to lack of income to build improved or modern houses or structures. Households with dairy cattle managed to increase their income through dairy activities. The overall picture is that households with dairy cattle were well off in terms of structures than those without dairy animals.

Table 3: Percentage distribution of sex, of respondents, age categories and type of houses of dairy cattle and non-dairy cattle owners

Variables	Dairy cattle owners		Non- dairy cattle owners	
	Frequency	Percentage	Frequency	**Percentage**
Sex of respondents				
Males	23	45.0	26	**49.1**
Females	28	55.0	27	**50.9**
Total	**51**	**100.0**	**53**	**100.0**
Age of respondents (years)				
16-25	0	0.0	1	**1.9**
26-34	15	29.4	20	**37.7**
35-44	10	19.6	15	**28.3**
Above 45	26	51.0	17	**32.0**
Total	**51**	**100.0**	**53**	**100.0**
House(s)/ of households				
Main house				
Modern house	29	56.7	21	**47.6**
Improved house	20	39.2	22	**41.5**
Poor house	2	3.9	10	**18.9**
Total	**51**	**100.0**	**53**	**100.0**
Kitchen				
Modern house	18	36.0	10	**18.9**
Improved house	21	42.0	14	**26.4**
Poor house	11	22.0	23	**43.4**
No kitchen	0	0	6	**11.3**
Total	**51**	**100.0**	**53**	**100.0**
Toilet				
Modern building	29	56.7	21	**47.6**
Improved structure	20	39.2	22	**41.5**
Poor structure	2	3.9	10	**18.9**
Total	**51**	**100.0**	**53**	**100.0**

4.2 Mating Systems

Natural service is the main mating system in the study area, using their own bulls, or hiring bulls from neighbours or fellow farmers. Inefficient heat detection could lead to late detection and late service, which reduces chances of conception. The majority (83%) of the respondents hire bulls for mating. About 4.4% either hire bulls or use their own bulls as indicated in Table 4. Shekimweri (1982) as cited by Urassa (1999) reported slightly lower results (70.9%) of respondents practicing natural service as their major mating system. The reason why majority of respondents practiced bull hiring as a mating system

was because of the mode of obtaining heifers. Recipients were supposed to originate from poor families having no other animal(s) and a few resources, consequently could not acquire their own bulls. It has been observed that there were no artificial insemination (AI) services in the study area because those services had not yet been introduced. The study concurs with observations by Mulangila (1997) that more than half of respondents in Tanga region practiced natural services through bull hiring; Kisusu *et al.* (2003) who reported that most of the smallholder farms in Mvumi, Dodoma adopted natural breeding method using hired bulls for breeding their animals. Mwatawala (2006) and Gimbi (2006) also reported the use of bulls for breeding purposes in Kagera region and Rungwe district, respectively. The reason for a wide spread use of natural service was that AI had not yet been introduced in the study area and also some respondents said it was more costly to keep dairy bulls in terms of management.

It was also revealed that farmers had little knowledge on heat detection. The method used by respondents for heat detection was by visual observation of signs of heat. Delay in conception followed by low calving rate is attributed to this system of bull hiring. However, due to fodder scarcity particularly during the months of July to November, some farmers let their dairy animals graze with local cattle, a practice which is not recommended since there would be no breeding control and record keeping. It would be advisable to start artificial insemination (AI) centres like the one previously proposed in Igunga township, together with employing a qualified AI officer who would completely concentrate on breeding of dairy cows. About 4 percent (2 respondents) did not have dairy cows because the animals had died shortly after calving. These two farmers only remained with bulls which are to be sold in order to purchase heifers. Huitema (1982) cautioned that if natural service is used while the bull is genetically unproven and any benefits which

might accrue from natural service must be set against the slower rate of genetic progress. Discussion with respondents revealed that farmers mated their cows several times (up to thrice) prior to conception. The delay in conception can probably be caused by feed and mineral deficiencies particularly during the dry periods. Adegbola (1986) reported that dairy cows are mated in such a way to allow a dry period of 6 to 8 weeks to enable the cows to recuperate. It could be advisable that farmers should be educated in detecting the early signs of heat. This would increase an annual calf crop which is beneficial to farmers.

Table 4: Sources of bulls used for mating

Sources of bulls	Frequencies	Percentage
Owning a bull	1	**2.6**
Hiring a bull	41	**83.0**
Own and or hire a bull	7	**14.4**
Total	**49**	**100.0**

4.3 Dairy Cattle Performance

In the study area dairy cattle are mainly F1 cross bred animals of Friesian and Boran. Their milk production is low within 5 to 10 litres per day and as a result there is competition of milk between man and the newly born calf as also observed by Lyimo et *al.* (2003). The situation imposes a problem of proper feeding of the calf in the dairy enterprises. However, there were variations whereby one respondent claimed to milk up to 18 litres (although it was exceptional) of milk per day and another respondent was getting only 2 litres of milk per day. The study also revealed that there were F2 crosses of F1 bulls and F1 cows which are said to possess inferior traits for milk production and that could probably be the reason of low milk production observed. The respondent who obtained 18 litres of milk was among the first recipients of F1 crossbred heifers supplied from Mabuki Heifer Project in Mwanza. Haile *et al.* (2007) observed that cross breed cows of Ethiopian Boran with Holstein Friesian had milk production potential of not exceeding 10 litres. Due

to unimodal distribution of rainfall in the study area, annual seasonal growth, unavailability of pasture is being experienced. The monthly income from sales of milk was found to be ranging from 45 000/= to 60 000/=. This amount was higher than that reported by Kisusu et al. (2003) for dairy farmers in Mvumi Dodoma which was 12 580/= per month.

4.3.1 Calving interval (CI)

Respondents were asked to indicate the calving interval (CI) they experience in their farms. The mean CI was shown to be 16.1 months or 491 days; minimum CI was 15 months and the maximum was 19 months, as shown in Table 5. The CI in this study is associated with poor reproductive performance of crossbreed dairy cows. Mchau (1991) reported that most cross bred cows would have calving intervals ranging from 390 to 450 days. The mean CI from this study was higher than that reported by Rugambwa *et al.* (1994) of 482 days for Friesian x Boran crosses in Kagera Tanzania; Balikowa (1997) a CI of 484.6 days for pure *Bos taurus* and their crosses with *Bos indicus*, in Southern Highland of Tanzania, and CI of 480.0 days was reported by Mwatawala (2006) in Kagera Region. Buckley and Mee (2006) noted that CI varied between 357 and 380 days, and also showed that there was an increase in CI between the first and the second lactation.

4.3.2 Lactation lengths (LL)

The mean lactation length (LL) was observed to be 7.4 months (about 226 days) while the minimum and the maximum LL were 6 months and 11 months respectively (Table 5). Tabatabai *et al*. (1984) reported the mean LL of 7.8 months in smallholder farmers in Jamaica. The mean LL in this study is shorter than what had been reported by Mwatawala (2006) of 12 months and Syrstad (1985) who reported the mean LL for *Bos taurus* and

crossbred cattle in most parts of the tropics to range between 280 and 345 days. Msuya (2002) reported a high mean LL of 350 days of crossbred in Kagera region.

Short LL demonstrated by tropical dairy cattle is primarily a result of environmental factors and that as standards of management and feeding improve the situation changes (Mahadevan, 1966 as cited by Payne, 1990). LL is considered to be highly variable. Due to the great variations in LL, a 305 days LL has been internationally accepted as standard (Araudoba, 1993). The amount of milk produced in a lactation period of 305 days is the unit measurement employed in developed countries for judging the milk production potential of a dairy cow (Mwatawala, 2006). The main advantage of 305 days of LL is corresponding very closely to the average lactation of cows calving once a year. The variation in LL could be attributed to differences in levels of management and feeding considering that the study area is very dry for about half of the year. It is expected that in the years to come farmers would gain more experience in dairy cattle management, hence better lactation yield leading to longer lactations. From this study it has been observed that grade cattle cannot produce to their optimum unless farmers adopt improved dairy cattle management like feeding, housing and disease control.

4.3.3 Age at first calving (AFC)

The average AFC was reported to be 33 months, the minimum and maximum AFC was 24 and 64 months respectively, as shown on Table 5. It has been observed that the mean AFC from this study relates to other AFC from different studies. Leaver (1987) reported an average AFC to be 33 months which resembles the results from this study. The AFC in this study is higher due to low planes of nutrition during rearing giving rise to delayed puberty and first service. The mean AFC of 33 months in this study is also similar to

various studies by Kifaro (1984) who observed an AFC of 33 months at Uyole Agricultural Centre in Tanzania, Kasonta and Rushalaza (1993) also observed AFC of 33 months for crossbred cows in Tanzania. Likewise, the overall AFC of heifers and cows in the study area of 33 months for F1 and F2 crosses is similar to the mean AFC of 33 months reported by Agyemang and Nkhonjera (1990) when working on cross bred cattle on smallholder farms in Malawi. Other studies (Balikowa, 1997; Msuya, 2002) revealed higher AFC among dairy cattle kept under smallholder farmers. Both reported a mean of 36.7 months. Mureda *et al.* (2007) when working with crossbred cows in Ethiopia reported AFC of 36.2 months. Lovince (2004) when studying in Bukoba and Turiani observed AFC of 35.1 months which was also higher than that observed in this study. While Gimbi (2006) in Rungwe district reported an AFC 30.8 months which was lower than that observed in this study. The reason for higher AFC obtained in this study could be attributed to poor feeding and health care especially during the early stages of development.

4.3.4 Dry periods (DP)

The mean dry period length in this study was of 92 days while the minimum was 60 days and the maximum dry period length was 150 days as indicated in Table 5. DP had a range of 90 days, and the reason of such a large variation is due to cows being poor milk producers. The DP reported in this study was lower than that reported by Balikowa (1997) of 128 days in smallholder dairy farmers at Iringa and Mbeya Regions, and Agyemang and Nkhonjera (1986) when working in two large farms under smallholder dairy farms in Malawi, found the mean DP of 179 and 133 days, and 109 days in smallholder farms. Mulangila (1997) reported a mean DP of 142 days which was also higher than that observed in this study. The DP allows the cows' mammary glands to rest; generate new

secretory cells. Castle and Watkins (1979) reported the DP to be 56 days for cows and 70 days for heifers.

Table 5: Dairy cattle performance statistics

Parameter	Calving Interval (months)	Age at first Calving (month)	Lactation length (months)	Dry period length (days)
Mean	16.1	33.0	7.4	**92.3**
Median	16.0	30.0	7.0	**72.0**
Std. Deviation	2.65	9.55	1.41	**16.5**
Range	4.0	40.00	6.00	**90.0**
Minimum	15.0	24.00	5.00	**60.0**
Maximum	19.0	64.00	11.00	**150.0**
N	**51.0**	**51.00**	**49.00**	**49.0**

4.3.5 Calf mortalities

The most common milking system practiced in the study area by small scale producers is twice a day milking. Some dairy farmers used to milk with a calf on foot mainly because a calf can be allowed to suckle for several minutes for milk let down. This system results in too little milk consumed by the calf which impairs its growth. Normally the calf is separated from the cow during the night. Since calves are weak because they suckle inadequate amount of milk they end up with nutritional deficiencies and diseases like diarrhoea. Calf mortalities would result because calves have not developed immunity system in their bodies. In a period of six years (2000 to 2006) it was found that 14 out of 52 calves born, had died and the major cause of death being diarrhoea. Williamson and Payne (1978) observed that calf mortalities in the tropics are very high and can reach 50%, and this is because of poor management, although in some areas death rates are partly due to unacclamatized temperature and climatic stress. However, calf death rate of 26.9% in this study was relatively small as when compared to observations made in the tropics (Williamson and Payne, 1978).

Dairying is adversely affected by death of animals. From this study it has been observed that 41 (27%) of all animals (of which 9% were calves) have died and this has generally affected the progress of dairy cattle activities in the study area as indicated in Table 6. Mchau (1991) when studying the impact of upgrading the Tanzania Short horn Zebu (TSHZ) in smallholder dairy farms in Mbeya region, Tanzania reported calf deaths of 12% in the herd because of scours and pneumonia.

The results also showed that 27 (66%) adult animals have died mainly because of diarrhoea, eating plastic materials, famine, toxin/ poisoning, tick borne diseases (TBDs') and foot and mouth disease (FMD). Deaths because of poisoning/ toxins, famine and eating of plastic materials, were attributed to weather condition of the study area being dry, such that animals consume even unwanted materials because of feed scarcity. These results (death because of toxins) were similar to that of Kifaro (1995) in one farm in Mbeya region (Southern Highlands of Tanzania) where 151 weaners and heifers had died when they were fed copper sulphate in concentrates as a remedy to copper deficiency. TBDs' were also found to be the major cause of death of calves than other diseases like FMD and diarrhoea as reported by Maloo (1993) and cited by Mwatawala (2006).

Table 6: Number of dairy cattle that died and their causes

Causes of death	Dead calves	Dead cattle	Total animals died
Tick borne diseases	1	4	**5**
Diarrhoea	8	1	**9**
Milk fever	0	4	**4**
Eaten polythene materials	2	4	**6**
Famine	2	3	**5**
Foot and mouth disease	0	1	**1**
Fractures	0	3	**3**

Poisoning/toxins	1	7	**8**
Total	**14**	**27**	**41**

Tick borne diseases are among the major constraints of dairy activities in the study area. Table 6 shows that 12.0% of dairy animals died of tick borne diseases. Reynolds *et al.* (2000) observed that tick borne diseases particularly East Coast Fever (ECF) had a severe impact on dairy cattle in terms of milk reduction as well as death. Muraguri *et al.* (2005) noted that among the vector – borne diseases, the incidence of ECF was high (23%) and was the major cause of calf mortalities in Kwale District, Kenya.

4.3.6 Number of animals kept and feeding of dairy cattle

Smallholder farmers on average reared 2.3 animals per household which was similar to findings by Gimbi (2006) in Rungwe district who also reported households rearing an average of 2.3 animals each. Urassa (1999) in Tanga found smallholder farmers rearing 1-2 dairy cows. Few farmers supplement their animals, and preferably cows during milking whereby a mixture of cotton seedcake and maize bran was offered to cows. The reason for not supplementing all animals is largely due to high costs of those inputs, an observation also made by Luoga (2005) in Rungwe district and Mwatawala (2006) in Kagera region.

4.4 Amount of Milk Produced and Consumed In a Household

The minimum and the maximum amount of milk produced in the study area per household were 2 and 18 litres respectively. The mean amount of milk produced was 6.9 litres, while the average amount of milk consumed in a household was 1.8 litres. The amount of milk sold (5.1 litres) was not very far from that reported by Urassa (1999) in Tanga where the average of 6.7 litres of milk was sold per respondent; and by Luoga (2005) in Rungwe district whereby 5.7 litres were sold. However, milk produced is lower than that reported

by Mwatawala (2006) who reported an average milk yield of 9.5 litres which was slightly higher than that reported by Hayan- Malambo (1998) of 8.0 litres for smallholder farmers in Zimbabwe and by Mchau (2003) of 9.0 litres for smallholder dairying producers in Mbeya Region.

Sour milk traditionally forms an important part of the diet. In the study area fresh milk is seldom drunk alone, but is used to make tea. Annual milk consumption per capita per year was computed as follows: The mean amount of milk consumption was 1.8 litres per household. The mean household size was 6.8 persons. Hence amount of milk consumed was 1.8 litres/6.8 persons; equals to 265 millilitres per person per day. The mean LL in the study area was 7.4 months (226 Days). Therefore, the mean milk consumption in the study area was 265 millilitres times 226 days, equals to 59.8 litres approximately 60 litres per year. This implies that milk consumption in the study area was higher than the estimated milk consumption in Tanzania of 40 litres per capita per year; although is still lower than the FAO recommendation of 200 litres (MLD, 2006).

However, since the milk yield is relatively low, producers prefer selling milk to obtain cash for household expenditures. Kisusu (2003), when studying the impact of dairy cattle on poverty reduction in Dodoma, Tanzania observed that smallholders prefer selling milk rather than consuming. Furthermore, Agyemang *et al.* (2007) observed that consumption levels of dairy products were influenced by population concentration and that access to markets influenced farmers towards specialization to other milk products.

4.4.1 Household milk consumption of dairy and non-dairy cattle owners

The mean household milk consumption was 1.8 litres per day. The minimum and maximum amounts were 1.0 litre and 3.0 litres respectively. When each observation is converted on annual basis, results are shown in Table 7. Those results indicate that 52% of households with dairy cattle consumed milk ranging from 500 - 700 litres per year as when compared to only 26.4% of households without dairy cattle. However, 11.3% of households without dairy cattle were found not to consume milk at all. Factors that might explain this include low purchasing power of the households and the peoples' attitude towards milk consumption.

Farmers who did not drink milk at all, to them milk consumption is considered as a luxury, since milk was found to be expensive. It was also observed that 62.3% of households who did not practice dairying were consuming less than 500 litres of milk per year compared to 41% of households practicing dairy farming.

Table 7: Comparison in milk consumption between households with and without dairy cattle

Milk consumption range (litres) / household / year	**Dairy cattle owners**		**Non dairy cattle owners'**	
	Frequency	Percentage	Frequenc y	**Percentage**
0 consumption	0	0	6	**11.3**
300 to 400	8	16.0	20	**37.8**
401 to 500	13	25.0	13	**24.5**
501 to 600	18	35.0	10	**18.9**
601 to 700	9	17.0	4	**7.5**
Above 700	3	7.0	0	**0.0**
Total	**51**	**100.0**	**53**	**100.0**

4.4.2 Comparison between amount of milk consumed and family size

Respondents were asked to indicate the amount of milk consumed and sold in a household. The results indicated that each household consumed an average of 1.8 litres per day, and about 5 litres were sold per day. A regression model was employed to determine the contributing factors to the amount of milk sold per household as shown in Table 8. The results indicated that family size and milk production per day were statistically significant ($p < 0.001$). This has an implication that as the milk produced increases by one litre there is an increase in amount of milk sold by 0.894 litres. Moreover, as the family size increases by one person, there would be an increase in 0.92 litres of milk sold. As stated earlier, an increase in family size implies an increase in labour power. Since the household members are the main source of labour, dairy farming would be relatively easy and more milk would be produced and ultimately more milk sold and consumed too.

However, Somda *et al.* (2007) noted that increase in home consumption of milk lead to a decrease in sales of milk produced as well as reducing the number of farmers' participation in milk marketing. Other variables such as age of the household head and amount of milk consumed were found not to influence amount of milk sold. The results suggest that households with dairy cattle are likely to be more food secured because milk consumption improves nutritional status of individuals. As indicated on Table 8, the amount of milk produced per day had a positive relation with the amount of milk sold. This implies that households that produce more milk can sell more milk and remained with some amount for consumption relatively to what they produced. Contrary to households that produce small amount of milk, they can sometimes sell all the milk produced and remained with nothing for household consumption since they are highly in need of income for their basic necessities.

Table 8: Linear regression coefficients for factors influencing the amount of milk sold per household (n = 49)

Factors	Regression coefficients (b)	S.E	P > F
Milk production per day	0.8941**	0.0214	**0.0001**
Family size	0.9204**	0.0128	**0.0001**
Education level	0.0146NS	0.0013	**0.6223**
Amount of milk consumed	0.0162NS	0.0023	**0.4223**
Age of household head	**- 0.0146NS**	**0.0013**	**0.8084**

* Significant at the 0.05 level (2-tailed).
** Significant at the 0.01 level (2-tailed).

4.4.3 Distribution of household by the incomes of dairy and non dairy cattle owners

The mean total annual household income of dairy cattle owners was 2 941 955/= while the minimum and the maximum incomes were 1 356 600/= and 5 700 000/= respectively. Moreover, the mean total annual household income of non-dairy cattle owners was 1 22 083.4, the minimum and the maximum incomes were 856 321.7 and 3 120 000/= respectively. About 69.8% of respondents who are not keeping dairy cattle had income ranging from 100 000/= to 2 000 000/= compared to only 33.3% of dairy cattle keepers as shown in Table 9. More than half (53.0%) of dairy cattle owners earn incomes between 2 million and 3 million compared to only 24.5% who don't practice dairy farming. Only dairy farmers had income of more than 4 million but none was found among respondents who don't keep dairy cattle. According to those results it has an implication that dairy farming households had more income and it is undoubtedly that the cause of higher income

was through dairy activities. Furthermore, the income obtained might be used to increase crop yield particularly cash crops and ultimately increase total annual household income.

Table 9: Distribution of households by the income (Tshs) of dairy and non dairy cattle owners

Statistics	Dairy cattle owners' income (Tshs)		Non dairy cattle owners' income (Tshs)	
Mean	2 213 299.0		**1 224 083.0**	
Minimum	1 356 600.0		**856 321.0**	
Maximum	5 700 000.0		**3 120 000.0**	
Proportion (%) earning	**Freq.**	**%**	**Freq.**	**%**
100 000/= to 1 000 000/=	3	5.9	12	**22.6**
1 000 001/= to 2 000 000/=	14	27.4	25	**47.2**
2 000 001/= to 3 000 000/=	27	53.0	13	**24.5**
3 000 001/= to 4 000 000/=	5	9.8	3	**5.7**
Above 4 000 000/=	2	3.9	0	**0.0**
Total	**51**	**100.0**	**53**	**100.0**

4.5 Influence of Various Sources of Income to Total Household Income of Dairy Cattle Owners

Dairy activities had correlation ($r = 0.489$; $p < 0.01$) with total household income as Table 10 indicates. Average milk produced in the study area was 6.9 litres. This means that the amount of milk expected to be sold per day doesn't exceed five litres. The average price per litre was 380/= hence the household was expected to earn a minimum of 57 000/= per month. However, this amount of income would depend on the number of lactating cows per farmer and if all things like diseases and transport does not interfere production and transportation of the produce.

Table 10 indicates that employment had higher mean annual income (rank first), and dairying ranked third in household income contribution. Forty nine out of fifty one respondents reported to obtain their income from dairy activities. Twenty six respondents

out of fifty one obtained their income from small enterprises (including kiosk owning, brick making, charcoal making and selling). With the exception of employment, the mean income from small enterprises (income generating activities) was higher than other mean sources of income and that is the reason IGA's ranked second in contribution to household income.

Table 10: Influence of various sources of income to total household income of dairy cattle owners

Independent variables (Annual income from)	N	Mean income (Tshs)	Rank	Pearson's moment correlation (r-value)	Level of significant (p-value)
Agriculture	40	455 334	4	0.358	**0.025 ***
Dairying	49	601 921	3	0.489	**0.002 ****
Employment	11	895 690	1	0.683	**0.014 ***
IGA Small enterprises	26	780 793	2	0.437	**0.042 ***
Gardening	9	208 217	5	0.538	**0.135**
Total		**2 941 955**			

* Significant at the 0.05 level (2-tailed).
** Significant at the 0.01 level (2-tailed).

Furthermore, dairying as a source of income ranked third, while agricultural activities ranked fourth. However, forty out of fifty one respondents were engaged in farming activities. Since all respondents were not engaged in farming activities their mean incomes were slightly lower than the mean income from dairying, and that was the reason farming activities ranked lower than dairying in income. Gardening was practiced by nine out of fifty one respondents. It has been observed that their contribution to household income was proportionately low as Table 10 indicates.

This study resembles another study carried out by Randolf *et al.* (2007) when studying the role of livestock in human nutrition and health for poverty reduction in developing countries. He found out that livestock keeping was important for many of the poor in the developing world because of its multiple livelihood objectives and offering pathways out of poverty. Mdegela *et al.* (2002) noted that dairy activities contributed significantly to poverty alleviation and reduction of malnutrition particularly in rural and peri- urban areas since they provide regular income to the household, self employment particularly to women and a valuable human food. Furthermore, Larsen *et al.* (2004) observed that on-farm milk production through keeping of crossbred cows had a significant impact on increasing revenues from milk sales up to ten times as when compared to the traditional system with only zebu cows. Kristjanson *et al.* (2007) when studying on rural poverty in Peru found that livestock played an important role for poor rural households in that region. She observed that a significant number of households had moved out of poverty in 40 communities.

4.6 Crop –Dairy Integration

Results revealed that 47% of respondents use income obtained from milk in crop production. The minimum amount of income spent on crop production was 10 000/=, the maximum was 300 000/= and the mean amount spent on agriculture was 70 520/=. The respondents used revenues from milk to purchase fertilizers and improved seeds in production of paddy, maize, sorghum and horticultural crops. The remaining respondents (53%) did not use income from dairy enterprises for crop production and this is because they have other sources of income like wages, while some were conducting small business which might be used to purchase food or use it for crop production.

When farmers were asked what they knew about crop and dairy cattle integration they replied that it involves utilization of crop residues as cattle feeds and application of manure as fertilizers. Likewise, they said that dairy animals can be used to provide power for cultivation, weeding and transportation, (although few farmers practice it using dairy cattle but rather with indigenous breeds). This would represent the highest level of development of subsistence economy involving dairy cattle. In India, Brumby (1981) reported a complementarity between dairy and crop enterprises on small farms, whereby farmers were reported to use earnings from the sale of milk to finance the purchase of improved seeds and fertilizers. The practice had significantly contributed to increase in field crops. Among the five dominant crop- livestock diversification pattern identified was that households that kept improved cattle and grew fruits were found to earn higher incomes and apply more organic manure as observed by Iiyama *et al*. (2007).

Conversely, households that grew staple crops with or without indigenous animals were found to apply less manure. Education, participation in farmers' groups, access to regular follow up by extension officers and family size were probably key factors affecting adoption of crop- livestock diversification patterns. Gimbi (2006) reported that cattle manure was used for crop production in Rungwe District, but farmers failed to recycle the nutrients leading to decrease in pasture production.

4.6.1 The influence of cattle manure on crop production and increase in household income

A t-test was computed to find if there were differences in income after use of cattle manure. The results revealed that there were statistically significant different ($t = 2.12$; $p \leq 0.05$) as indicated in Table 11. The results concur with those found by Larsen *et al.* (2004) on farm biodiversity in Holetta area of Ethiopia; Kumsa *et al.* (2004) in Holetta

Agricultural Research Centre in Ethiopia who also found that people living around that centre observed changes in yield ($p < 0.05$) after use of cattle manure. The results were also similar to that of Bayer *et al.* (2006) where they observed that cattle manure doubled maize yield in Mbeya, Tanzania.

Table 11: The influence of cattle manure on crop production and increase in household income

Variables compared	Mean	N	t- value	p-value
Income before use cattle manure	637 360.0	51		
Income changes after use of cattle manure	2 941 955.0	18	2.12	0.026
Income before joining dairy activities	629 959.0	51		
Income after joining dairy activities	2 941 955.0	49	1.903	0.037

The results from this study closely resemble that of Iiyama *et al*. (2007) in Rift Valley community of Kenya ($t= 2.09$; $p<0.01$), and Pagot (1992) who reported that cattle manure when applied to farms can increase fertility in cropland, and that an increase in crop production as a result of use of farm yard manure, can lead to food security together with increase in cash crop which increases purchasing power and reduces poverty. The practice of applying farm yard manure is currently emphasized by extension workers. The contribution of cattle manure to increase in crop yield was further reported by Goldin and Reinert (2006) that rice is grown by two thirds of Vietnamese and rice exports increased the incomes of small farms and indeed supported rural income to alleviate poverty through the use of farm yard manure.

4.6.2 Annual incomes before and after joining dairy activities

Dairying had assisted smallholder farmers in the study area to increase their income. The mean household income before and after joining dairy activities were 629 959.0 and 2 941 955 ($t = 1.903$; $p < 0.05$) respectively. Table 12 shows that before joining dairy activities more than four fifth (84.4%) of the respondents had incomes of less than one milion; and only 3.9% had incomes of more than two milion per year.

Table 12: Annual incomes before and after joining dairy activities

Range of income (Tshs)	**Before joining**		**After joining**	
	Frequencies	Percentage	Frequencies	**Percentage**
10 000/= to 500 000/=	27	52.9	1	**2.0**
500 000/= to 1 000 000/=	16	31.5	4	**8.2**
1 000 000/= to 1 500 000/=	2	3.9	11	**22.4**
1 500 000/= to 2 000 000/=	4	7.8	9	**18.4**
Above 2 000 000/=	2	3.9	24	**49.0**
Total	**51**	**100.0**	**49**	**100.0**

At a period of 12 years, after joining dairy enterprises almost 90% of households had incomes above one million and only 8.2% of respondents earned less than one milion per year. Moreover, about half (49%) of them had incomes of more than two milion. It has been observed that those who had incomes of less than one milion are the ones who recently joined dairy enterprises. It is expected that with good management practices, dairy cattle activities would be among the major sources of income which would ultimately reduce poverty in the study area in the near future.

4.6.2 Changes in yield after use of manure

Results from this study indicate that about three quarters of respondents (72%) observed changes in yield after application of cattle manure, and the crop yields have doubled as shown in Table 13. The addition of cattle manure (organic matter) to salty soils is a common recommendation since it improves drainage allowing salt to be leached (washed) below the root system of the crop as reported by Curtis (2007).

For sustainable crop production in most parts of Tabora region farmers were reported to use organic and inorganic fertilizers in mixture mainly to exploit the complimentary effects and reduce fertilizer costs. Kumsa *et al.* (2004) reported a situation whereby farmers mixed organic and inorganic fertilizers around Holleta Agricultural Research Centre in Ethiopia. This is also practiced by some respondents in the study area mainly in paddy fields and it has increased crop yield from 20 – 40 bags per hectare to 45 – 60 bags per hectare, as indicated in Table 13. Pender *et al.* (2004) reported that smaller farms using cattle manure resulted in obtaining higher crop production per hectare, while households with fewer or no livestock had lower crop yields.

Table 13: Observed changes in yields and after use of cattle manure

Before use of cattle manure	**After use of cattle manure**	**Frequenc y**	**Percentag e**
20-40 bags of paddy per hectare	45 -60 bags of paddy per hectare	14	**28.0**
3-7 bags of maize per	6-10 bags of maize per	18	**36.0**

hectare	hectare		
2-3 baskets of vegetables	5-6 bags of vegetables per	1	**2.0**
per week	week		
50-80 tins of tomatoes per	120 -200 tins of tomatoes per	3	**6.0**
hectare	hectare		
Application not done/	Application not done/	14	**28.0**
changes not observed	changes not observed		
	Total	**51**	**100.0**

4.6.3 Reduction in mineral fertilizer use

Apart from all benefits obtained from the use of cattle manure, it has another advantage of reducing the use of industrial fertilizers. Nearly one third of the respondents (35.3%) stated that they are mixing mineral fertilizers with cattle manure from their herds (Table 14), a practice which improved crop yields. However, 64.7% of respondents said they neither use cattle manure nor mineral fertilizers hence they did not know whether or not there was a reduction in use of mineral fertilizers. The market value of nitrogen fertilizer (50 kg urea which is commonly used in the study area) was 42 000/=. On further questioning the respondents, they indicated that they apply a minimum of 4 bags of nitrogen fertilizer, and a maximum of 10 bags per hectare. Since some farmers (35.3%) stated that they did not use mineral fertilizers any more because they use cattle manure, it implies that those farmers can save a minimum of 168 000/= and a maximum of 420 000/=, while the mean amount saved because of the use of cattle manure was 294 000/=.The amount saved might be used for other household expenditures and at the same time harvesting the same produce as if they had used mineral fertilizers.

Table 14: Reduction in mineral fertilizer use

Use or not using cattle manure	Frequencies	Percentage
Mixing inorganic and cattle manure	18	**35.3**
Using neither cattle manure nor mineral		

fertilizers	33	**64.7**
Total	**51**	**100.0**

4.6.4 Use of crop residues as livestock feed

Almost all dairy cattle owners (94.1%) used crop residues to feed their animals. The most commonly used crop residues were rice straws, (obtained from Mwamapuli Irrigation Scheme situated 9.0 km south of Igunga township) and to a lesser extent maize stover and potato vines. Means of transporting those residues is through ox-carts and other farmers use trucks and tractors. The major problems facing dairy farmers were high costs of purchasing those residues, at the same time the farmers were required to purchase them in a short span of time. This is because if farmers delay to purchase crop residues at the period of harvesting, local cattle would graze and deplete them. A single trip of ox-cartful of rice straw costs from 4 000/= to 6 000/= and under normal circumstances one is required to purchase 10-12 ox-carts that could be sufficient to feed his/her 2-3 dairy cattle for 6 months.

A similar situation was observed by Huitema (1982) whereby animal husbandry goes together with agricultural activities, where crop residues were used to supply enough fodder of sufficient quality during the whole year. Few farmers use crop residues from their own farms like maize stover and sweet potato vines to feed their dairy cattle. Some respondents obtain crop residues freely from their fellow farmers and neighbours and few used to exchange crop residues with other commodities, like exchanging one ox-cart of rice straw with one tin of raw paddy. The minimum amount of income spent to purchase of crop residues was 15 000/=, highest was 50 000/=, and the mean amount of money spent to purchase crop residues was 30 455/=.

4.7 Milk Marketing

About two fifths (39.6%) of dairy cattle farmers said that buyers came to collect milk themselves at their homesteads; more than one third (37.5%) have to walk towards the market access and 22.9% used bicycles to access milk market (Table 15). Providing access to transport to marginalized people/areas is an essential element in selling farm products including milk. Improvement in milk marketing system is desirable for small dairy producers and traders, and more so with the poor in low income countries. Most of smallholder farmers in rural areas face serious problems of marketing their milk especially during the rain season. The rural poor can only get out of poverty if there are functional markets that add value to their produce.

Market opportunities for milk are largely in urban areas where people have high purchasing power, although efforts can be done to stimulate demand in rural areas. As indicated in Table 15, two thirds of respondents (67%) mainly from Igunga and some from Mwanzugi villages sell their milk at Igunga township and 12.2% sell at Mwanzugi village alone. About 8.3% of respondents sell their milk at Nyandekwa and Nkinga while 4.2% sell at Ziba centre.

Milk producers from Mwanzugi and a few from Nyandekwa transport their milk to selling centres covering a distance ranging from 8 to 12 kilometres on foot or by bicycle. The distance from production to consumption affects milk consumption, as it was also reported by Mutabuzi (2002) during his study in Mbeya and Iringa in Tanzania and Luoga (2005) when working in Rungwe District, Mbeya, Tanzania. The distance covered to access milk markets influences income of milk producers, since sometimes they encounter

impediments like rain or bicycle breakdown which lead to failure in disposing their milk. This observation also conforms to that reported by Kurwijila and Mdoe (1989) that the frequencies of farmers sending their milk to distant places decreased when distance increased. The low frequencies were attributed to lack of transport facilities and that farmers had to transport their produce on foot or bicycles. Table 15 also shows that 41.7%, 31.3% and 14.6% of respondents sell their milk to neighbours, *mama lishe* (food vendors) and kiosk owners respectively. A small amount of milk is sold to middlemen and individuals who constituted 6.3% each.

Likewise, about half of farmers were fairly accessible to the market in terms of distance and time as parameters determining milk market access. The findings from this study was similar to a study by Ashimogo and Kurwijila (1992) as cited by Luoga (2005) who found that most dairy products were marketed through inter-household sales within farmers location. In another study, Mwatawala (2006) reported that milk was mainly sold as fresh milk to milk vendors and some to households probably because of low milk production and lack of markets, a situation also observed in this study. In his model, Bogers (2001) included among other variables the distance and means of transportation to assess to what extent the transaction costs influence the marketing channel.

Table 15: Percentage distribution of means of milk transport, milk buyers and market centres

Variables	Frequencies	Percentages
Means of transport		
Bicycles	11	**22.9**
On foot	18	**37.5**
Buyers collect milk themselves	19	**39.6**
Total	**48**	**100.0**
Milk buyers		

Neighbours	20	**41.7**
Mama lishe (food vendors)	15	**31.3**
Kiosks	7	**14.6**
Middlemen	3	**6.3**
Others	3	**6.3**
Total	**48**	**100.0**
Market centres		
Igunga	32	**67.0**
Mwanzugi	6	**12.5**
Nyandekwa	4	**8.3**
Nkinga	4	**8.3**
Ziba	2	**4.0**
Total	**48**	**100.0**

4.7.1 Mode of payment during selling of milk

The distances from the dwelling to the marketing place as well as the mode of transportation were considered to be important aspects in transaction costs. Table 16 shows that the dominant (47.9%) mode of payment during selling of milk was monthly payment. Furthermore, cash on delivery payment was applied (29.2% of respondents) as a mode of payment to individual customers due to their failure to comply with agreed terms. That situation indicated that there was absence of contractual agreements in the existing milk marketing systems.

Smallholder farmers conceived that monthly payment mode was preferred since it facilitates income accumulation in a household (Mabula, B.; Sungi, M.; Maharage, F. and Hassan, M. Personal communication, 2007). The amount obtained might be used to pay water bills, electricity bills, school fees and some for paying treatment charges. All those can be accomplished when a farmer has a lump sum rather than daily pay which is difficult to accumulate. Daily pay mode of payment results in fluctuation of revenues and net income which according to farmers distorts their development plans. One study in Kenya by Mbogoh and Ochuonyo (1990) showed that payments to producers for milk delivered were often late and farmers commonly received payment up to two months after delivering

milk. Dairy farmers have thus often found themselves unable to plan for efficient use of their resources. They observed that delayed and/or irregular payments also made milk production expensive and risky.

Table 16: Percentage distribution of mode of payment after selling milk

Variables	Frequencies	Percentages
Mode of payment		
Daily pay	14	**29.2**
Weekly	8	**16.7**
After two weeks	3	**6.2**
Monthly	23	**47.9**
Total	**48**	**100.0**

4.7.2 The influence of various variables to the total income from dairy activities

Income from dairy activities was moderately influenced ($r = 0.442$; $p < 0.01$) by distance from where milk was produced to the market place as Table 17 indicates. More than half of milk producers have to walk or use bicycle (refer Table 15), and if there occurs problems like mechanical failure of bicycles or milk producers fell sick, then the income would be affected since she/he cannot be able to sell milk on that/those day(s). When dairy animals die it is an economical loss since the household would fail to obtain milk for consumption and sell. Moreover, calves die if proper management practices are ignored. An increased number of milk buyers would motivate many households to keep more dairy cattle and in turn would increase their household income, which would contribute in reducing poverty to those households. The number of animals died had a negative sign, ($r = - 0.111$; $p > 0.05$) implying that as the cows die, amount of milk production cease and this affect the income of households since there is no milk to sell. Despite their

contribution to milk production, it has been observed that cull cows, heifers and bulls were sold alive. Table 17 indicates that the number of animals sold were found to be statistically significant ($r = 0.358$; $p < 0.01$). This means when animals are sold the income obtained contributes to the household income.

Table 17: Correlation between some independent variables and the total income from dairy activities (n=51)

Independent variables	Pearson's moment correlation (r- value)	Level of significant (p –value)
Number of animals died	- 0.111	**0.311**
Number of milk buyers	+0.064	**0.332**
Number of animals sold	+0.358	**0.006****
Distance from production to the market place	**+0.442**	**0.009****

** Significant at the 0.01 level (2-tailed).

4.7.3 Farmers' comments on price of milk

Table 18 shows that more than half of respondents (56.3%) indicated that the price of milk was satisfactory (380/= per litre), and according to the respondents it implied that the price of milk caters for input/output relation. About 20.8% of them said the price was moderately satisfactory, while 22.9% commented the price to be unsatisfactory. Although more than half of respondents commented the price to be satisfactory, observations made by the researcher and the district officials showed that the selling price of milk was not satisfactory. At least Tshs 500/= could assist dairy cattle householders to cater for their basic necessities. Smallholder dairy farmers claimed the price to be satisfactory mainly because there were little or no marketing and utility charges like taxes and electricity through their selling. Their comments towards selling price of milk were attributed to

increased costs of feeds like cotton seed cakes, maize bran and treatment charges particularly in Igunga township.

Though some farmers supplement their dairy cattle, the selling prices of their milk were relatively low since there was little demand of milk in rural compared to urban areas. However the amount of milk sold was significantly dependent ($r = 0.601$; $p < 0.01$) on the total amount of milk produced per household per day. A similar observation was found by Araudoba (1993) when studying on the factors influencing off- take and marketing of milk and milk products around Dodoma town in Tanzania.

Table 18: Comments made by farmers on price of milk(n=48)

Comments	Frequencies	Percentages
Unsatisfactory	11	**22.9**
Moderately satisfactory	10	**20.8**
Satisfactory	27	**56.3**
Total	**48**	**100.0**

4.7.4 Size of milk market

More than half of respondents (52.9%) found the size of milk market to be moderately large, while only 27.5% said the market was large as Table 19 indicates. The reason of having such responses (moderately large and large size of milk market) was largely because of the increase in population in Igunga township. Civil servants or privately employed individuals have increased following road construction and development of cotton ginneries as well as increase in institutions. Furthermore, there is an increase in hotels and guest houses which are good consumers of milk.

Table 19: The percentage distribution of the size of milk market

Market size	Frequencies	Percentages
Relatively small	7	**13.7**

Moderately large	27	**52.9**
Large	14	**27.5**
Do not know	3	**5.9**
Total	**51**	**100.0**

4.8 Major Economic Activities

The study also looked at the major economic activities performed and their estimated income. Farming was observed to be the main economic activity whereby 68.6% of the respondents were farmers (Table 20). Agriculture (farming activity) is the predominant occupation in most developing countries. The economics of almost all developing countries are dominated by the agricultural sector. Leather and Foster (2005) viewed agricultural activities as the stimulus to economic growth, increased farm employment and increased quality of food supply.

Employment was found to be another economic activity in the study area. Civil servants and privately employed individuals constituted 13.7% of respondents, while 7.8% of dairy cattle owners practiced livestock keeping as their major economic activity and the rest (5.9%) practiced small enterprises. Although Kemp (1994) found employment as the path out of poverty but also indicated that many people continue to be in poverty despite being civil servants or privately employed.

Table 20: Percentage distribution of major economic activities of respondents

Major household economic activities	Frequencies	Percentages
Farming activities	35	**68.6**
Employed civil servants	7	**13.7**
Privately employed	1	**2.0**
Livestock keepers	4	**7.8**
Housewife	1	**2.0**
Petty traders	3	**5.9**

Total	**51**	**100.0**

4.9 Constraints Encountered in the Dairy Project

The study was also aimed at identifying constraints encounted by the smallholder dairy farmers in their day to day activities. Table 21 shows that dairy production was limited by fodder scarcity largely because the study area becomes very dry due to prolonged dry season. Multiple responses computed revealed that the major leading constraint was lack of pasture for their dairy enterprises. It has been found that 35 out of 51 respondents (68.6%) showed that pasture scarcity was their major constraint in their dairy activities. This constraint forces dairy cattle keeper to purchase fodder for their animals normally from rice straw for about 6 months, and some farmers fail to afford since the costs are relatively high. A single trip of ox-cartful of paddy residues costs 4 000/= to 6 000/=, and if a farmer has 3 animals she/he has to purchase about 12 ox-carts, a situation which is unaffordable by most of smallholder farmers. Therefore, during that period dairy cattle are underfed, a practice which affects their milk production. About 39.2% of all respondents indicated that animal diseases was the second constraint and the diseases identified were diarrhoea, tick borne diseases, FMD, milk fever and some animals ate poisons/toxins (Table 21).

Table 21: Percentage distribution of constraints encountered in the dairy projects (n=51)

Constraints encountered	Frequencies	Percentages
Pasture scarcity	35	**68.6**
Animal disease	20	**39.2**
Water unavailability/ drought	13	**25.5**
Dipping services	14	**27.4**
Milk marketing	9	**17.6**
High prices of drugs	9	**17.6**
Thieves	6	**11.7**
Supplementary feeds	5	**9.8**

Lack of breeding bulls	4	**7.8**
Grazing land	2	**3.9**
Lack of capital/ credits	1	**1.9**
Irregular payments	1	**1.9**
No unions for milk producers	1	**1.9**
Transport facilities	1	**1.9**
Deaths of cows shortly after death	2	**3.9**
Inadequate heat detection skills	3	**5.9**
Funds for monitoring/supervision	**2**	**3.9**

Table 21 indicates that 14 out of 51 (27.4%) of all respondents said that dipping services was a problem and it has been found that 5 dairy cattle have died of tick borne diseases. If dipping facilities were adequate, death because of tick borne diseases would be minimized. Other constraints that were listed included high prices of drugs, scarcity of water, inadequate heat detection skills and animal diseases. Further, inaccessibility of markets for milk, lack of breeding bulls, supplementary feeding and thieves were mentioned as problems hindering the dairy enterprises. Jingura *et al*. (2001) observed that one of the major constraints to milk production from the smallholder sector is lack of adequate good quality feed and diseases.

4.10 Comments on the Dairy Cattle Project

When asked to comment on the advantages of having the dairy cattle project, almost all (96%) dairy cattle owners said it was profitable (Table 22). The respondents showed positive attitudes towards the project since they were the beneficiaries of dairy cattle products and by products. Mwakalile *et al*. (2002) reported that small holder dairy farmers in Southern highlands of Tanzania had successfully improved their nutritional status through milk production. Milk becomes an important cash crop for those farmers and the manure produced was highly valuable. Ndambi *et al.* (2007) observed that due to better management of resources, access to inputs and markets, dairy farming using improved breeds was highly profitable in Central Uganda.

Livestock ownership and personal income levels are often positively correlated among rural households. In one study in Punjab, Karunaratne and Wagstaff (1985) as cited by Iiyama (2007) observed that income of livestock owners was found to range between 38% and 48% higher (depending on the size of holding) than households with crop but no milk sales. In another study (Abdullah, 1990) it has been reported that livestock keeping was a banking strategy and played a role in capital (wealth) accumulation. Milk seems to be the major livestock product in income generation in rural areas, but other livestock products such as skins and hides are given little attention according to that author. Limbu (1999) reported that intensive dairying in a rural set up of Tanzania using crossbred cows can be very profitable. He stated that the profitability of US $ 760 per cow per year was more than 3 times higher than the national poverty line of US $ 211.

Table 22: Comments on the dairy cattle project

Comments	Frequencies	Percentages
Good	49	**96.0**
Fairly	1	**2.0**
Bad	1	**2.0**
Total	**51**	**100.0**

4.10.1 Major expenditures from income accrued from milk sales

Table 23 shows the major expenditures of income from milk whereby 51.0% of respondents stated that income from milk was used in general household expenditures. About a quarter of the respondents (23.5%) used income from milk for paying school fees. This has an implication that there was no proper plan on how to spend income from milk, and this applies to all other sources of income, as the amount of income obtained doesn't satisfy household basic necessities. As observed above, income from dairy activities has contributed in farming activities; about 9.8% of the total household income was used in

crop production. Furthermore, through income accrued from milk sales, there was much improvement in houses whereby modern houses were built by households practicing dairying. Moreover, kitchens and toilets were also improved through the use of income from dairy enterprises.

Table 23: Percentage distribution of the major expenditures of income from milk sales (n=51)

Expenditure of income	Frequencies	Percentages
Household expenditures	26	**51.0**
School fees	12	**23.5**
Household implements as assets	2	**3.9**
Medical services	3	**5.9**
Electricity and water bills	3	**5.9**
Farm activities	5	**9.8**
Total	**51**	**100.0**

4.10.2 Assets acquired from dairy enterprises and their values

Table 24 shows building materials purchased, structures for animals and houses built for the households. Likewise there was rehabilitation of the cow sheds. Some farmers managed to purchase assets like bicycles, radios, sewing machines, television sets and refrigerators. As indicated earlier, dairy farming has contribution to farming activities and this was showed by purchase of three ox- carts and five ox-drawn ploughs together with draught animals purchased. Dairy farming apart from providing milk for consumption and other benefits explained above was more profitable to households as they have managed to acquire assets and structures that were not possible. At the period of 12 years respondents have managed to acquire assets and building structures worth Tshs 7 922 000/= (Table 24).

Table 24: Assets acquired from dairy enterprises and their value

Building materials	Structures built rehabilitation	Assets	Farming implements	Animals
Corrugated iron sheets 107 pieces =965 000/=	Building of 11 cow's shades were built =1 486 000/=	5 Bicycles = 380 000/=	5 Ox-drawn plough 335 000/=	12 cattle (local stock) 900 000/=
Cement 24 bags = 258 000/=	Chicken 4 Chicken bandas built 275 000/=	5 radios 460 000/=	3 ox-carts 650 000/=	4 oxen 650 000/=
Iron bars 17 pieces=153 000/=	Kiosk establishment 150 000/=	2 sewing machines 175 000/=		
	Rehabilitation of 2 cows shade = 70 000/=	1 Refrigerator 280 000/=		
		3 Television sets 660 000/=		
		Household utensils 75 000/=		
1 376 000/=	1 981 000/=	2 030 000/=	985 000/=	1 550 000/=

Total = 7 922 000/=

4.10.3 Respondents being members of community health fund (CHF)

Respondents were asked if they had access to health services. The results indicated that 94.1% of dairy cattle owners and 77.4% of non dairy farming households had access to health services (Table 25). It has been found that some households were not members of community health fund (CHF) a board which provides medical services after contributing Tshs 10 000/= per household per year. It was also revealed that 52.9% of dairy cattle households and 34.0% of households without dairy cattle were members of CHF. Since

households that practice dairy farming had daily/monthly incomes through sales of milk, they can't face health services problems because they are capable of paying the CHF contribution or pay cash for health services.

Table 25: Respondents access to health services and being a member of CHF

	Dairy cattle owners		**Non dairy cattle owners**	
	Frequencies	Percentage	Frequencies	**Percentage**
Access to health services				
Access	48	94.1	41	**77.4**
Do not access	3	5.9	12	**22.6**
Total	**51**	**100.0**	**53**	**100.0**
Member of CHF				
Members	27	52.9	18	**34.0**
Not members	24	47.1	35	**66.0**
Total	**51**	**100.0**	**53**	**100.0**

4.11 Access to Extension Services

Almost all dairy cattle owners (98%) had access to their extension officers. When asked to grade their performance, half of them (51%) said it was good, the rest claimed the performance of extension officers to be fair, meaning there were no regular visits made by the extension officers. Agriculture and livestock extension agents were also interviewed in this study on how they delivered technical messages. They indicated to face some constraints including inadequate resources such as transport facilities and working tools which hindered extension services. They also revealed that there was farmers' resistance to change on issues requiring cash expenditure like dipping of dairy cattle.

Farmers Field School (FFS) started in Igunga district in late 1990's aimed at organizing farmers to build demand capacity in Integrated Pest Management (IPM) programmes particularly in cotton, maize and sorghum. Braun *et al.* (2006) noted that FFS is in a state of adaptation and that under FFS, farmers could learn easily and quickly better ways to manage their crops with efficient use of resources. Therefore, the same approach might be employed to build demand capacity to smallholder dairy farmers. Under FFS approach, good livestock husbandry including feeding, disease control, housing, treatment, marketing of dairy products, cleanliness, watering and genetic improvement might be delivered to dairy cattle owners. The results from this study imply that there was sufficient contact between farmers with extension agents. The major problem could probably be farmers not to adhere to the advice provided by the extension agents.

4.12 Access to Credit Facilities

In this study, almost all (98%) dairy cattle owners had no access to credit facilities which is a constraint in development of dairy enterprises. However, only one farmer complained about lack of credits, meaning that credits are not as important as pastures and diseases. Verbal communications revealed that the farmer wanted to access credits so as to purchase more in-calf heifers. A different situation has been observed by Gundersen and Offutt (2005) who pointed out that those farm families with income below the poverty line are far less likely than wealthier farmers to access credit facilities. They further indicated that poor families are also not participating in other assistance programmes. Alexandratos (1995) indicated that smallholders were impeded by restricted markets, input supply problems, limited access to extension services, risk aversions and tenure insecurity, hence the benefits of the new technology tended to benefit large landholders. Lack of credit facilities was also among the constraints to dairy development in Iringa and Mbeya

Regions as observed by Mwakalile *et al.* (2002) and in Rungwe District, Mbeya Region by Gimbi (2006).

4.13 Resources Owned by the Households

More than half of respondents (57.1%) stated that land was their major resource since most of them depend on agriculture for their livelihood. Other resources in the study area included house(s), livestock, milling machines, kiosks and motorcars. In Tanzania all land is publicly owned and vested in the state, but individuals have users right (MAC, 1999). There are three major land tenure systems, namely customary or communal, commercial leasehold and the right of occupancy. Majority of households in the study area own land under communal system acquired through inheritance from parents, purchased, hired, given by village government or cleared forests.

4.14 Other Species of Livestock Kept by Dairy Cattle Owners

Livestock keeping is considered to be another important source of income in the study area, as a way of storing wealth, solving social and cultural problems, as well as a source of food. Households keep different species of livestock. However, many households in the study area prefer keeping cattle, sheep and goats because they fetch higher income on selling compared to other livestock like poultry. Other incomes obtained by households practicing dairying from sales of 12 cull cows and 4 bulls were 1 900 000/= while 4 oxen sold contribute 900 000/= at a period of six years (2000 to 2006) as shown in Table 26.

Small ruminants make a significant contribution to the farm economy in mixed farming, as they provide meat and income to households. Small ruminants are ideal for improvement of the livelihood in the study area. During the period of six years (2000 to 2006), about 28

sheep and 115 goats were sold and contributed 142 000/= and 1 380 000/= respectively to the total household income. Furthermore, animals can be consumed particularly during the festivals. It has been observed that the mean numbers of small ruminants currently reared are about 8 animals per household. Thomson (1997) reported small ruminants to contribute as much as 30 percent of the meat and milk in Sub-Saharan Africa. In areas too dry for cropping like some parts of the study area, they are the sole source of income for the households. Poverty is often greatest in the marginal cropping and driest areas. Panin (2008) when studying the profitability and contribution of small ruminants to rural African households found that there was evidence that small ruminants were both profitable and economically viable. Their small size and rapid growth rates make small ruminants a more flexible short term form of investment than cattle (ILCA, 1990).

Traditional chicken production is practiced in the study area whereby chickens are allowed to scavenge for their feeds. When asked on how poultry contribute to household income, some respondents said chickens can increase household income through sales of eggs and live chickens. An income from sales of chickens was 1 130 000/= whereby 320 birds were being sold and about 9 100 eggs sold had contributed 610 000/= to the total annual household income. Moreover, eggs and meat were consumed by the households and it is estimated that each household consumed about 370 eggs and 13 birds per year. Poultry are kept in almost all households in the study area in traditional system whereby they can provide manure for home gardening and are also required for special festivals and for traditional ceremonies. The contribution of poultry in smallholder income, food requirements and social aspects is largely increasing. Riise and McAinsh (2001) reported that in terms of income generation keeping of small flocks of 5-50 birds under improved management, may make a big difference for poor people. In a study by Alders *et al.*

(2007), they noted that chickens play a vital role in many poor rural households in the provision of animal protein in the form of eggs, meat and can be bartered or sold to meet essential family needs.

Pig production is another activity performed in the study area. It has been found in Table 26 that one respondent practiced pig production and at least 2 animals were sold monthly. This implies that a farmer can obtain about 3 600 000/= annually from pig production. Moreover, it has been observed that dairy cattle owners' households could get an income of about. 9 716 000/= from sales of animals and their products annually as Table 26 depicts.

Table 26: Animals and products sold, their values and the current range of animals of dairy cattle owners

Animals/ products sold	Total income (Tshs)	Range of animals owned
12 cull cows and 4 bulls	1 900 000.0	**4 - 8**
4 oxen	900 000.0	**2 - 6**
115 goats	1 380 000.0	**3 - 15**
28 sheep	196 000.0	**1 - 8**
320 Chicken	1 130 000.0	**2 - 20**
Eggs	610 000.0	**-**
Pigs about 24 per year	3 600 000.0	**25**
Total	**9 716 000.0**	

In this study it has been observed that some dairy cattle owners (about 29.4%) were also engaged in keeping other livestock species while a few (15.2%) were observed in non-dairy cattle owners keeping other animals (Table 27). Large proportion (84.9%) of those without dairy cattle did not even keep local cattle, sheep and goats or chicken, and this is

because as stated earlier most of respondents depended on farming and other income generating activities for their livelihood.

Table 27: Percentage of respondents keeping other animals

Animal categories	Dairy cattle owners		Non dairy cattle owners	
	Frequency	Percentage	Frequency	**Percentage**
Tanzania Shorthorn Zebu	3	5.9	3	**5.7**
Sheep and goats	5	9.8	2	**3.9**
Chicken	6	11.7	3	**5.6**
Pigs	1	2.0	0	**0.0**
Not keeping other animals	36	70.6	45	**84.9**
Total	**51**	**100.0**	**53**	**100.0**

4.15 Comparison of Annual Income from Dairying, Crop Production, Employment and Other Income Generating Activities (IGA)

Dairy activities contributed 20.4% to the total annual income of household practicing dairying while none was found to contribute in household without dairy cattle as indicated in Table 28. The mean household incomes of dairy cattle owners were twice as much as the incomes from households without dairy cattle. However, these results are very low compared to that reported by Karunaratne and Wagstaff (1985) as cited by Luoga (2006) who reported the income from dairy to be higher ranging from 38% to 48% of the total household income.

Table 28: Comparison of mean annual incomes from different activities

Activities	Households with dairy cattle		Households without dairy cattle	
	Mean income (Tshs)	% of mean	Mean income (Tshs)	**% of mean**
Dairying	601 921	20.4	0	**0**
Agriculture	455 334	15.5	371 434	**30.3**

Employment	895 690	30.4	302 105	**24.7**
IGA's :				
Small enterprises	780 793	26.6	413 730	**33.8**
Gardening	208 217	7.1	136 814	**11.2**
Total	**2 941 955**	**100.0**	**1 224 083**	**100.0**

The main source of the income in households without dairy cattle was small enterprises or other income generating activities (IGA) which contributed 33.8% of the total household income. Other IGA's included fishing, charcoal making and selling, brick making, carpentry and masonry. Farming activities contributed 30.3% the total annual household income of dairy farmers, as compared to 27.2% of the total annual income from households who keep dairy cattle. Moreover, income from sales of milk was an important source of diversification of farm incomes. The respondents acknowledged that their incomes had increased after keeping dairy cattle and therefore increased their purchasing power for food and other household necessities.

4.16 Contribution of Various Sources of Income to Annual Household Income among Farmers without Dairy Cattle

Correlation computed revealed that there was a small relationship (r =0.342) (Table 29) between the total annual household income of farmers without dairy cattle and the annual income from agricultural activities. However, agricultural activities seemed to have little contribution to the total annual household income although 91% (URT, 2007) of the total district populations depend on agriculture for their livelihood. It has been observed that the only major cash crop grown in the study area was cotton, and currently the selling price of the crop is relatively low as compared to the production costs. Prices of inputs are very high such that in past the five years many farmers have rejected cultivating cotton. Maize is grown as a food crop and paddy as a multipurpose crop is now sold since there is no other crop which is used as the source of income. Since the farmers have no alternative

source of income, crops harvested are immediately sold to middlemen where farmers obtain low prices. This was the cause of low contribution of agricultural activities to household income.

Devereux and Maxwel (2001) reported that agriculture accounted for some 20% of GDP in Sub- Saharan Africa in the provision of food that people can eat. According to these authors, agriculture is the major source of livelihood in generating employment as over two thirds of the labour force is engaged in it. Kumar *et al.* (2007) noted that agriculture was the prime source of livelihood for majority of rural population in the North-East region of India. Increasing economic growth, reducing food insecurity and accelerating poverty reduction particularly in rural areas, requires an increase in agricultural productivity, higher added value and improved producer price incentives (URT, 2006 b).

Table 29: The influence of incomes from different activities on the total annual household income from non- dairy activities (n=53)

Independent variables (Annual income from)	Mean income (Tshs)	Pearson's moment correlation (r-value)	Level of significant (p-value)
Agriculture	371 434	0.342	**0.028***
Employment	302 105	0.605	**0.395**
IGA :			
Small enterprises	413 730	0.520	**0.048 ***
Gardening	136 814	0.740	**0.006****
Total	**1 224 083**		

* Significant at the 0.05 level (2-tailed).
** Significant at the 0.01 level (2-tailed).

4.17 The Successes of Igunga Heifer Project

Among other successes of the project, it has been observed that milk consumption has increased (1.8 litres per day per household) since formerly there was no milk consumption in those households. Increased incomes resulting from sale of milk has enabled them to pay school fees for children, pay for medical charges, improve houses/shelters and purchase household supplies. It has also been reported that there was an increase in number of meals from 1 to 3 per day (according to information obtained from district officials). Two dairy heifers and one dairy calf bull were sold and contributed 650 000/= to three households, the amount which is larger than when indigenous animals are sold. Furthermore, increase in crop production through use of cattle manure was also reported. The cows produce high quality milk which has high demand therefore marketing of milk produced was not a big problem. The project was a challenging one, however through proper management recipients could benefit since the cows provided are relatively high yielding ones as compared to production from local herds.

In order to fulfill the objectives of Tanzania to reduce absolute poverty by half by 2010 (stipulated in URT, 2003) with income as an indicator for poverty, dairy farming should be given much importance by more people being mobilized to keep dairy cattle and drink milk.

4.18 Regression Model Analysis

The three independent variables (X_1 to X_3) were chosen for inclusion in the model because they were thought to account for much variation in the total household income. Dairy farming is practiced by all respondents. Agricultural activities and small enterprises were also found to contribute much to household incomes and practiced by many dairy cattle

owners. The annual income of agricultural activities, dairying, small enterprises and the total annual household incomes were sub divided into two parts which were (1) the household income below and (2) the annual household income above the mean. When regressed the annual household income and the independent variables the results are shown on Table 31 and 32. However, kiosk owning, employment, casual labour, gardening and animal keeping were found to be done by few respondents. These were the limitations in carrying out this regression model. The multiple correlation (R) of 0.861 (Table 30) found in this model indicates that the independent variables chosen were ideal for explaining the relationship between them and the total annual household income. This high R value suggests that the model fitted well the data, implying that the regression model was strong t explain the relationship between the total annual household income and the independent variables. This implies that only 13.9 percent of the variances (in kiosk owning, employment, casual labour, gardening and animal keeping) were not explained by the three variables in the equation.

Adjusted R squared (R^2) takes the number of independent variables (agricultural activities, small enterprises, and dairying incomes) were involved and found to be 0.772 meaning that 77.2 percent of the variations in the total household incomes were due to those independent variables entered into the regression equation. The rest 22.8% was due to errors in the model and variables not entered in the model.

4.19 Interpretation of the Regression Results

When considering one variable (dairying) it was explaining 68.3% of the total annual household income. Furthermore, when combining all three variables the household income increased to 86.1%. However, as Table 31 depicts, if all variables were performed small

enterprises (though in small amounts) and dairying were the only ones contributing to household income. With dairying and small enterprises there was a linkage in increasing household income. The linkage might be through the sale of dairy products or any other activities, and that is the reason for relatively low contribution of small enterprises to household income. The positive sign indicates direction of change which is an increase and a negative sign indicates a decrease. Agricultural activities had a pulling back effect of the income (non significant) in the sense that it can reduce the total annual household income. The standardized better coefficients of dairying had a positive sign (0.261), implying that dairy activities had an impact (contributed) in increasing the household income. The standardized beta coefficients of agricultural activities and small enterprises had negative signs - 0.040, and - 0.128 respectively. This had an implication that agricultural activities and small enterprises respectively had negative impacts on the total household income. Each of the regression coefficients estimates the amount of change that occurs in the total household income. Impacts of agricultural activities and dairying were found to be non significant. Hence it can be concluded that among other variables, dairy cattle enterprises had contribution in increasing household income and this would reduce poverty.

4.20 Forward multiple regression analysis

AHI = Annual household income (dependent variable)

AHI_1= a +ß 1X dairying

=1.045 + 0.261dairying

AHI_2 = a + ß 2X dairying + ß 1X small enterprises

= 1.231 + 0.262 dairying - 0.128 small enterprises

AHI_3 = a + ß 2X dairying + ß3X small enterprises +ß 1X agriculture

= 1.318 + 0.261 dairying - 0.132 small enterprises - 0.040 agriculture

Table 30 indicates the forward multiple regression used to compute the contribution of dairy cattle to poverty reduction to annual household income. The variables entered in forward multiple regression were incomes from dairying activities, small enterprises and agriculture, and their additive contribution to R^2 were 0.683, 0.845 and 0.861 respectively.

The results on Table 31 shows that dairying was statistically significant ($p < 0.01$) to the total household income, and this signifies that dairy farming had a contribution to the total household income. Agricultural activities were non significant and as indicated, it is advisable that smallholder dairy farmers should not be engaged in farming activities. Therefore those households which are not practicing dairy farming are encouraged to keep dairy farming and those who are now in HIP are urged to adhere in better management practices for more milk production which will determine their incomes and reduce poverty. However, as an intervention towards poverty reduction according to the results, smallholder dairy farmers in the study area are advised to keep dairy cattle than doing other activities or do other activities in a lesser extent such that it does not interfere the income which might be obtained from dairying.

Table 30: Forward multiple regression results

Models	Independent variable	R	R Square	Adjusted R Square	Std error	R square change	Level of Significant
Model 1	Dairying	.462(a)	.683	.653	.47842	.683	.000
Model 2	Dairying Small enter.	.723(b)	.845	.786	.47499	.163	.020
Model 3	Dairying						

	Small enter. Agriculture	.074(c)	.861	.772	.47535	.016	.463

a Predictors: (Constant), Dairying
b Predictors: (Constant), Dairying, Small enterprises
c Predictors: (Constant), Dairying, Small enterprises, Agriculture

Table 31: Regression Coefficients results

Model	Independ. Variables	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	1.045	.084		12.451	.000
	Dairying	.259	.054	.261	4.766	.000
2	(Constant)	1.231	.115		10.699	.000
	Dairying	.258	.054	.261	4.786	.000
	Sm. enter	-.126	.054	-.128	-2.344	.020
3	(Constant)	1.318	.165		7.977	.000
	Dairying	.259	.054	.261	4.799	.000
	Sm. enter	-.131	.054	-.132	-2.409	.017
	Agric.activ.	-.047	.063	-.040	-.735	.463

a Dependent Variable: Total HH income level

4.21 Relevance of the hypothesis

The null hypothesis in this study was: “Dairy cattle production in Igunga has no impact on poverty reduction. While the alternative was “Dairy cattle production in Igunga has an impact on poverty reduction.” Basing on the findings from the study the null hypothesis was rejected and the alternative hypothesis accepted as there were significant differences of livelihood of dairy cattle owners’ households to those who did not practice dairy farming. This was indicated in the regression analysis that the income of dairy cattle owners have increased after joining dairy activities, and the descriptive statistics which showed that members have acquired wealth from milk sales. The results show that there was an increase in expenditure to each item after joining dairy cattle activities. For example, there

was an increase in ability of more farmers to pay for the basic necessities such as school fees, health services, and improvement of their residence as well as acquisition of properties. Furthermore, the farmers increased ability to buy food, increase in savings and other holdings (furniture and utensils); and again there was an improved crop production through the use of cattle manure. In that way, poverty has been reduced among dairy cattle owners.

CHAPTER FIVE

5.0 CONCLUSIONS AND RECOMMENDATIONS

5.1 Conclusions

The aim of this study was to determine the contribution of smallholder dairy enterprises to poverty reduction in Igunga district. The results have shown that dairy farming has contributed much in increasing and ultimately reducing poverty among smallholder dairy farmers. The cash crops are cotton and paddy which is also a food crop. Other sources of income identified in the study area were employment and dairying. Likewise, income generating activities like brick making, charcoal making and selling, gardening, kiosk owning were identified as other sources of income.

Milk produced has helped the households to increase income for about four times from 629 959/= to 2 213 299/= in the lifetime of the project. Furthermore, income obtained has helped in paying school fees, medical charges; improve structures/shelters as well as acquiring assets for household uses. Moreover, milk produced was used for household consumption, as observed the mean household milk consumption was 1.8 litres a practice which formerly was impossible to those households. In addition, revenue obtained from dairy enterprises was used as investment in other income generating activities like kiosk owning.

There has been high and positive integration between crop and dairy farming. The use of cattle manure has substantially doubled the crop yield for all crops grown in the study area. Likewise there was a reduction of mineral fertilizer whereby farmers saved a mean of Tshs 294 000/= because of the use of cattle manure.

Smallholder dairy farming in the study area does not face much problems in marketing their milk because Igunga township is growing very fast. The dominant mode of payment after milk sales is monthly payment, and this mode is preferred since it facilitates income accumulation in a household.

Milk production ranges between 5 to 10 litres per day. Calving interval was found to be higher than the optimal range of 340 to 370 days in tropical countries. Poor management practices including disease control and nutritional deficiencies were the cause of higher CI and this reduces milk yield in the study area. The short lactation lengths demonstrated in this study is the result of environmental factors and is experienced in many tropical dairy cows.

The study had revealed an increase in household incomes for about four times, doubling of crop yield because of the use of cattle manure and the use of crop residues to feed dairy cattle. From what has been observed, it can be concluded that dairy farming had a significant contribution in increasing household income and reducing poverty of dairy cattle keepers.

5.2 Recommendations

Since smallholder milk producers are poor, the government has to support their development, production and distribution. The following are recommended;

(i) To educate farmers on the aspect of disease control including regular dipping, nutrition status of their cattle, proper fodder conservation particularly during dry season and proper heat detection techniques to allow timely mating.

(ii) Smallholder dairy farmers are requested to initiate dairy groups supported by development agencies like World Vision (T), other agencies and under supervision of local government i.e. agriculture and livestock development department. Dairy groups can assist smallholder dairy keepers in acquiring basic knowledge on the management of their animals in places where there are inadequate extension officers.

REFERENCES

Abdullahi, A. M. and Jahnke, H. E. (Eds.) (1990). *Some Aspects of Supply Behavour and Rural Livestock Marketing in Africa. Pasture production System in Africa. A study of nomadic household economy and livestock marketing in Central Somalia.* New York Press, USA. 359pp.

Abel, Y. K. S. (2000). Impact of the Southern Highlands dairy development project workload and gender relations in Njombe district. Dissertation for Award of MSc Degree at Sokoine University of Agriculture, Morogoro, Tanzania. 135pp.

Acamovic, T., Sinurat, A., Natarajan, A., Anitha, K., Chandrasekaran, D., Sindey, D., Sparks, N., Oduguwa, O., Mupeta, B. and Kitalyi, A. (2005). Poultry, In: *Livestock and Wealth Creation; (Edited by Owen, et al.), National* Resources International Limited; Nottingham University Press., UK. pp. 301 -324.

Adegbola, T. A., Anugwa, F. O., Nwosu, C., Okorie, A. and Orji, B. I. (1986). *Animal Science, Introduction to Tropical Agriculture.* Longman Scientific and Technical Group, UK. 253pp.

Agyemang, K. and Nkhonjera, L. P. (1990). *Evaluation of the productivity of the crossbred dairy cattle on smallholder on the Government farms in Malawi. International Centre for Africa Research No 2.* Government Printer, Malawi. 39pp.

Agyemang, K., Yapi - Gnaore, C. V., Ouologuem, B., Barge, P. P. and Adediran, S. A. (2007). Hypothesis on inland valley development for smallholder dairy production in three West African Countries Corte d' Voire, Mali and Nigeria. *Livestock Research for Rural Development Journal* 19: 4 - 10.

Akter, S., Farrington, J., Deshingkar, P., Rao, L. and Freeman, A. (2007). Species diversification, livestock production and income of the poor in the Indian state of Andra Pradesh. *Journal of Livestock Research for Rural Development* 19(11): 312 - 325.

Alders, R., Bagnot, B., Hanin, M. and Young, M. (2007). *Village poultry, food security and HIV/AIDS mitigation. Low External Input for Sustainable Agriculture (LEISA) magazine;* Published quarterly by ILEIA Amersfoot; Printed by Koninklijke BDU: Barneveld, The Netherlands Volume: 33 (3).

Alexandratos, N. (1995). *World Agriculture: Towards 2010 an FAO Study, Growth of Agricultural Production in Developing Countries.* Published by FAO of the UNO and John Wiley & Sons Ltd., USA. 203pp.

Amalu, U. C. (2005). Poverty alleviation and agriculture in Sub- Saharan Africa. The Nigerian perspective. *Journal of Food, Agriculture and Environment* 3(2): 230 -236.

Animut, G. and Goetsch, A. L. (2008). Co-grazing of sheep and goats. Benefits and constraints. *Small Ruminant Research* Journal *77*(3): 127 - 145.

Araudoba, C. N. (1993). Factors influencing off-take and marketing of milk and milk products around Dodoma town. Dissertation for Award of MSc Degree at Sokoine University of Agriculture, Morogoro, Tanzania.163pp.

Ardakan, M. A. and Emadi, M.H. (2004). *Managing livestock by-products in Iran: From field to market. In Low External Input for Sustainable Agriculture (LEISA) magazine;* Published quarterly by ILEIA Amersfoot; Printed by Koninklijke BDU: Barneveld, The Netherlands Volume: 20(3).

Babbie, E. R. (1994). *Survey Research Methodology*. *Second Edition.* Wadsworth Publishing Company Inc., Belmont California. 395pp.

Balikowa, D. (1997). Reproductive and lactation performance dairy cattle on smallholder farms in Iringa and Mbeya regions. Dissertation for Award of MSc Degree at Sokoine University of Agriculture, Morogoro, Tanzania.177pp.

Bayer, W., Kapunda, L. B. and Sassoon, P. (2006). Dairy Cattle for Poverty Alleviation in Southern Tanzania: Prosperity and poverty in globalized world-challenges for agricultural research. [http://www.tropentag.de/links/Bayer_D9E6ncIy.pdf] site visited on 25/01/2008.

Bebe, B. O., Udo, H. M. J. and Thorpe, W. (2008). Characteristics of feeding and breeding practices for intensification of smallholder dairy systems in the Kenya Highlands. *Livestock Research for Rural Development Journal* (Colombia) 20(2): 1 - 13.

Berry, S. (1985). *Milk Production in Developing Countries. Overseas Development Administration (ODA)*. Dominican Republic. London Press. 555pp.

Boger, S. (2001). Quality and contractual choice: A transaction cost approach to Polish hog marketing. *European Review of Agricultural Economics Journals* 28(3): 241 - 261.

Bourn, D., Martima, J., Motsamai, B., Blake, R., Nicholson, C. and Sundstol, F. (2005). *Livestock and the Environment.* In: *Livestock and Wealth Creation; (Edited by Owen, et al.), National* Resources International Limited; Nottingham University Press., UK. pp.145 -166.

Braun, A., Jiggins, J., Roling, N., Henk van B. and Snijders, P. (2006). A global survey and review of FFS experience. Final report for ILRI, Rietveldalaan., Wageningen, The Netherlands. [http://www.infobridge.org/asp/documents/1880.pdf] site visited on 16/5/2008.

Brumby, P. J. (1981). *Animal breeding and dairy development in India 32nd Annual Dairy Cattle Report.* Macmillan, NY. 235pp.

Buckley, F. and Mee, J. F. (2006). Management, nutrition and breeding strategies to improved dairy herd fertility. *Journal of Dairy Science* 86: 2308 - 2319.

Castle, M. E. and Watkins, P. (1979). *Modern Milk Production. Its Principles and Applications for Students and Farmers.* Faber and Faber Ltd., London. 296pp.

Chambers, R. (1986). *Putting the Last First. Rural Development.* Longman Group (FE) Ltd. Hong Kong. 142pp.

Chambers, R. (1989). *Farmers Innovation and Agricultural Research: Farmers first. Immediate Technology Publication.* Short Run Press Exeter., Great Britain. 137 pp.

Curtis, E. (2007). *The Use of Manure as Soil Amendment and Mulches for Vegetables and Ornamental Plants.* Colorado State University Extension; 2775 HWY Grand Junction Co., US. 10pp.

Dekeba, A., Ayalew, W., Hedge, P. and Tad else Z. (2006). Performance of the Albernosa Ranch in the production of Ethiopian Boran X Holstein crossbreed dairy heifers in Ethiopia. *Ethiopian Journal of Animal Production.* 6(1): 33 - 53.

Devereux, S. and Maxwel, S. (2001). *Food Security in Sub- Saharan Africa (SSA).* Institute of Development Studies. University of Natal., Press. South Africa.38pp.

FAO, (2003). . *An FAO perspective. World Agriculture Towards 2015/2030.* Earth scan Publications Ltd., (Edited by Jelle Bruinsma) UK and USA. 166 pp.

Gimbi, A. A. (2006). Assessment of reproductive performance of smallholder dairy cattle and possible interventions in Rungwe District, Tanzania. Thesis for Award of PhD Degree at Sokoine University of Agriculture, Morogoro, Tanzania. 270pp.

Goldin, I. and Reinert, K. (2006). *Globalization for Development, Trade, Finance, Aid, Migration and Policy.* The International Bank for Reconstruction and Development. Palgrave Macmillan., New York. 54pp.

Gueye, E. F. (2003). Gender issues in family poultry production in low income food countries. *American Journal of Alternative Agriculture* 18(4): 187 - 216.

Gundersen, G. and Offutt, S. (2005). Farm poverty and safety nets. *American Journal of Agricultural Economic* 87(4): 885 - 899.

Haggblade, S., Hazell, P., Kirsten, I. and Mkandawire, R. (2004). *African Agriculture: Past Performance, Future Imperatives.* IFPRI 2020 Vision Focus 12 Brief 1 Current 34: 7-10. [http://www.info.slu.se/currents 34] site visited on 16/5/2008.

Haile, A., Joshi, B. K., Ayalewi, W., Tegegne, A. and Singh, A. (2007). Economic comparison of Ethiopian Boran and their crosses with Holstein in Central Ethiopia. *Ethiopian Journal of Animal Production* 7(1): 77 - 87.

Haines, M. (1982). *Introduction to Farming System*. Longman Inc., New York, USA. 143 pp.

Hayan- Malambo, B. T., Sibamba, S. and Ostergaad, V. (1998). Social – economic aspects of smallholder dairying in Zimbabwe: Livestock Research for Rural Development. [http://www.cipac.org.co/lrrd/lrrd10/2 Zimbabwe] site visited on 25/1/2008.

Heffernan, C., Nielsen, L., Sidahmed, A. and Miah, T. (2005*). Livestock Development and Poverty.* In: *Livestock and Wealth Creation; (Edited by Owen, et al.),* National Resources International Limited; Nottingham University Press., UK. pp.71 – 88.

Huitema, H. (1982). *Animal Husbandry in the Tropics; Its Economic Importance and Potentialities. Studies in a Few Regions of Indonesia.* Published in Amsterdam, The Netherlands. 259pp.

IDC (2006). Igunga District Council. *Agriculture and Livestock Department Annual Report presented in Counselors Meeting held at Igunga DED's Hall, on 20th December*. 25pp.

IDC (2007). Igunga District Council. *Agriculture and Livestock Department Report for the Month of January 2007*. 23pp.

Iiyama, M., Maitima, J. and Kariuki, P. (2007). Crop- livestock diversification patterns in relations to income and manure use: A case study from a Rift Valley community, Kenya. *African Journal of Agriculture Research* 2(3): 58 - 66.

ILCA, (1990). International Livestock Centre for Africa. *Annual Report and programme highlights in Addis Ababa, Ethiopia*. Printed in UK. 106pp.

Jambia, G., Kulindwa, K. and Sosovela, H. (1997). *Problems, Policies and Perspectives. Poverty and Environment: The case of Informal Sand Mining, Quarrying and Lime Making Activities in Dar-es-Salaam.* Researching Poverty in Tanzania. Mkuki na Nyota Publications., Dar-es-Salaam, Tanzania. 474pp.

Jingura, R. M., Sibanda, S. and Hamudikuwanda, H. (2001). Lactation performance of dairy cows given conserved grass forages and supplemented with lablab hay and two different concentrates in the dry season. In: *Proceedings of the 28th Scientific Conference AICC- Arusha, December 3rd -5th. TSAP Conference Series* (28): 191 – 204pp.

Kasonta, J. S. and Rushalaza, V. G. (1993). Dual – purpose cattle in Central Tanzania. In: Future of Livestock industries in East and Southern Africa. In: *Proceedings of the workshop held at Kadoma Ranch Motel Zimbabwe (Edited by Kategile J.A. and Mumbi S.J.), 20-23rd July ILCA (International Livestock Centre for Africa), Addis Ababa, Ethiopia. 81-88pp.*

Kemp, A. A. (1994). *Poverty and Welfare for Women, Women a Feminist Perspective 5th - Edition.* Mayfield Publishing Company., Mountain View California, USA. 480pp.

Kifaro, G. C. (1984). Production efficiencies of *Bos taurus* cattle in Mbeya Region. Dissertation for Award of MSc Degree at Sokoine University of Agriculture, Morogoro, Tanzania. 128pp.

Kifaro, G. C. (1995). Performance of exotic dairy cattle in the Southern Highlands of Tanzania and prospects for genetic improvement. Thesis for Award of PhD Degree at Sokoine University of Agriculture, Morogoro Tanzania. 291pp.

Kisusu, R. W. (2003). Adoption and impact of dairy and irrigated rice technologies on poverty alleviation in Dodoma, Tanzania. Thesis for Award of PhD at Sokoine University of Agriculture, Morogoro, Tanzania. 204pp.

Kitalyi, A., Mtenga, L. A., Morton, J., McLeod, A., Thornton, P., Dorward, A. and Saadullah, M. (2005). *Why Keep Livestock if You are Poor*? In: *Livestock and Wealth Creation; (Edited by Owen, et al.),* National Resources International Limited; Nottingham University Press., UK. pp.13 – 27.

Koda, B. and Mukangara, F. (1997). *Beyond inequalities. Women in Tanzania, TGNP/SARDC;* Tanzania Gender Networking Programme and SARDC Government Press., DSM, Tanzania. 60pp.

Kristjanson, P., Krishna, A.; Radeny, M., Kuan, J.; Quilca, G., Sanchez-Urelo, A. and Leon- Velarde, C. (2007). Poverty dynamics and the role of livestock in the Peruvian Andes Agricultural systems UK, ILRI: *Livestock Research Journal for Rural Development.* 94(2): 12 - 25.

Kumar, A.; Staal, S.J.; Singh, N. P. and Singh, J. K. (2007). Livestock Sector Trade in India: Surging momentum in the new liberalized regime. *Indian Journal of Agricultural Economics* 62(3): 395 - 410.

Kumsa, T.; Madsen, J. O. and Tegegne, A. (2004). Manure production, handling and use around Holetta Agricultural Research Centre: *Challenges and Opportunities*, *Proceedings of a Conference.* [http://ilri.catalog.cgiar.org/dbtw] site visited on 12/5/2008.

Kurwijila, R. V. and Mdoe, N. S. Y. (1989). The role of women in smallholder milk production and marketing in Sub-Saharan Africa with particular reference to Kilimanjaro Highlands, Tanzania. In: *Proceedings of the 15th Scientific Conference of TSAP held in Arusha International Conference Centre 26th -28th September;* 15: 185-190.

Kurwijila, R. L. (2002). Dairy development in Tanzania. In: *Proceedings of a South – South Workshop held at Anand India* 13th –16th March 2001. *NDDB (National Dairy Development Board) India and (ILRI) International Livestock Research Institute Nairobi Kenya*. [http://www.Ssdairy.org/program.html]site visited on 4/2/2007.

Lanjouw, P., Quizon, I. and Sparrow, R. (2001). Non - agricultural earnings in peri- urban areas in Tanzania. Evidence from household survey. *Food Policy Journal* 26: (4): 385 - 396.

Larsen, G. E. S., Kumsa, T. and Tegegne, A. (2004). Exotic dairy breed turn into exhausted dairy breed when forced to reproduce, lactate and perform work at the same time; In: *Proceedings of the 11th Annual Conference of Ethiopian Society of Animal Production.* ESAP Proceedings 167-177. [http://www.ilri.org/def.] site visited on 12/5/2008.

Leather, H. and Foster, P. (2005). *The World Food Problem Tackling the Causes of Under Nutrition in the Third World 3rd Edition.* Lynne Rienner Publishers Inc., USA. 67pp.

Leaver, J.D. (1987). *Milk Production, Science and Practice*. Longman Handbook in Agriculture., Hong Kong. 173pp.

Limbu, F. (1990). Agricultural technology economic viability and poverty alleviation in Tanzania. *A Paper presented at the structural transformation policy workshop; Serena Hotel Nairobi.* 51 pp. [http://www.aec.msu.edu/fs2/ag] site visited on 19/5/2008.

Long, N. (1977). *An Introduction to the Sociology of Rural Development.* Taw stock Publication Ltd., UK. 146pp.

Lovince, A. (2004). Factors influencing breeding and reproduction efficiency in smallholder dairy cattle in Tanzania. A case study of Turiani Division and Bukoba District. Dissertattion for Award of MSc at Sokoine University of Agriculture, Morogoro, Tanzania.132pp.

Luoga, W.P. (2005). The Effect of market access on dairy performance and market orientation of smallholder farmers in Rungwe District, Mbeya. Dissertation for Award of MSc Degree at Sokoine University of Agriculture, Morogoro, Tanzania. 135pp.

Lyimo, H. N., Laswai, G. H., Mtenga, L. A., Kimambo, A.E., Mgheni, D.M., Hvelplund, T. and Weisbjerg, M. (2003). Pre- weaning performance of crossbred dairy calves reared on locally prepared calf concentrates. Tanzania Society of Animal Production. In: *Proceedings of the 30th Scientific Conference, held in Tanga 28th -30th October, 2003*, 30: 321-332.

Lyimo, H. N. (2006). Development of dairy calf rearing strategy for smallholder farmers in Turiani Division, Mvomero District. Thesis for Award of PhD Degree at Sokoine University of Agriculture, Morogoro, Tanzania. 276pp.

MAC (1999). Ministry of Agriculture and Cooperatives. *Unpublished annual report Development of Cooperatives and Institution development*, Dar-es –Salaam, Tanzania. 8pp.

Mahadevan, P. and Hutchson, H. G. (1964). The performance of *Bos indicus* and *Bos taurus* cattle for milk production in the coastal regions of Tanganyika. *Animal Production Journal 6*: 330 - 336.

Mbogoh, S. and Ochuonyo J. B. (1990). *The marketing system and the marketing and pricing policies for fresh milk. Kenya's Dairy Industries Report*. 287pp.

McDonald, P., Edwards, A., Greenhalgh, J. F. and Morgan, C. A. (2002). *Animal Nutrition, 6th edition.* Pearson Education Ltd and Bell & Bain Ltd, Glasgow., UK. 418pp.

Mchau, K. W. (1991). The impact of upgrading the Tanzania Shorthorn Zebu (TSHZ) on Smallholder dairy production in Mbeya region. Thesis for Award of PhD Degree at Sokoine University of Agriculture, Morogoro, Tanzania. 199pp.

Mchomvu, M.N. (2001). Socio-economic factors influencing farmers' participation in the traditional irrigation schemes; A case study of the traditional irrigation improvement programme (TIP) in Kilosa District. Dissertation for Award of MSc Degree at Sokoine University of Agriculture, Morogoro, Tanzania. 117pp.

Mdegela, R. H., Kusiluka, L. J. M., Kapaga, A. M., Karimuribo, E., Turuka, F. M., Bundala, A., Kivaria, F., Kabula, B., Manjurana, A., Tarleiv, L. and Kambarage, D.M. (2002). Prevalence and determinants of mastitis and milk borne zoonoses in smallholder dairy farming sector in Kibaha and Morogoro Districts Eastern Tanzania. In: *Proceedings of the First collaborative Research workshop on food security held in Morogoro*. 183-195pp.

Minot, N. (2007). Are poor, remote areas left behind in agricultural development: The case of Tanzania. *Journal of African Economies* 17 (2): 239 - 276.

MLD (2006). Ministry of Livestock Development 2006/07 Budget Speech.

Mlozi, M. R. S. (2001). Why urban dwellers raise livestock. Empirical evidence from towns in Tanzania. In: *Proceedings of the 28th Scientific Conference of Tanzania Society of Animal Production.* (Edited by Mmbaga, S.H. et al.), 3rd - 5th December 2001 AICC Arusha. 28: 74 – 92pp.

Mngulwi, E. S., Mukami, M. J., Kitosi, N. I. P. and Mgema, M. (2004). The role of extension services in livestock development. In: *Proceedings of the 31st Scientific Conference held at Kilimanjaro Crane Hotel.* 5th-7th October: TSAP Conference Series 162 – 166pp.

Msuya, R.S. (2002). Evaluation of dairy cattle performance under smallholder production systems in Kagera region. Dissertation for Award of MSc Degree at Sokoine University of Agriculture, Morogoro, Tanzania. 125pp.

Mtatifikolo, F. and Mabele, R. (1999). Development strategies and poverty reduction initiatives. Analytical discussion with applications to Tanzania (Eastern Africa Social Science Research Review). *Rural Economics Journal* 15(1): 33 - 52.

Mulangila, R. C. (1997). A study of dairy cattle productivity in Tanga region. Dissertation for Award of MSc Degree at Sokoine University of Agriculture, Morogoro, Tanzania. 132pp.

Muraguri, G. R., Mcleod, A., Mc Dermott, J. J. and Taylor, N. (2005). The incidence of calf mortality and morbidity due to vector – borne infections in smallholders dairy farms in Kwale District, *Kenya. Veterinary Parasitology Journal* (The Netherlands*)*. 130(4): 305 - 315.

Mureda, E. and Zeleki, M. Z. (2007). Reproductive performance crossbred dairy cows in Eastern Lowlands of Ethiopia. *Livestock Research for Rural Development Journal.* 19(161): 11 - 18.

Muriuki, H. G., Mwangi, D. M. and Thorpe, W. (2001). How smallholder dairy system in Kenya contributes to food security and poverty alleviation: Results of recent collaborative studies. In: *Proceedings of the 28th Scientific Conference of Tanzania Society of Animal Production.* (Edited by Mbaga, S. H. et al.), 3rd - 5th December 2001 Arusha, Tanzania, 28 – 35pp.

Mutabuzi, K.D.S. (2002). Analysis of milk marketing performance in liberalized economy: The case of Mbeya and Iringa Regions, Tanzania. Dissertation for Award of MSc Degree at Sokoine University of Agriculture, Morogoro, Tanzania. 168pp.

Mwakalile, I. N., Bachman, F., Mshana, Y. and Mugittu, V. F. (2002). *Twenty years of experience of Southern Highlands- Dairy Development in Mbeya and Iringa Regions. A report on improved livestock management and rural livelihood.* 54pp.

Mwangi, D., Methu, J., Hossain, M., Khan, S., Moyo, S., Pearson, A. and Romney, D. (2005). *Improving the Husbandry of Animals Kept by Resource Poor People in Developing Countries*. In: *Livestock and Wealth Creation; (Edited by Owen, et al.),* National Resources International Limited; Nottingham University Press., UK. pp. 433 – 450.

Mwatawala, H. W. (2006). Evaluation of performance of Kagera Region herds of cattle. Thesis for Award of PhD Degree at Sokoine University of Agriculture, Morogoro, Tanzania. 205 pp.

Ndambi, O. A., Garcia, O., Balikowa, D., Kiconco, D., Hemme, T. and Lohmann, U. L (2007). Milk production systems in Central Uganda. Farm economic analysis. *Tropical Animal Production Journal* 40: 269 - 279.

Nicholson, M. J. (1985). *Pastoralism and milk production. Report on milk production in developing countries presented at International Livestock Centre for Africa*, Addis Ababa Ethiopia. McMillan London Press . 54pp.

Pagot, J. (1992). *Animal Production in the Tropics.* Published by Macmillan Education Ltd., London & Basing stone, UK. 68pp.

Panin, A. (2008). A study on the profitability and income contribution of small ruminant production to rural Africa, Small ruminant research and development in Africa. [http://www.fas.org/wairdocs/ilri/5473b00] site visited on 13/5/2008.

Payne, W. J. A. (Ed.) (1990). *An Introduction to Animal Husbandry in the Tropics. 4th edition.* Published by John Wiley and Sons, Inc., New York., USA. 881pp.

Peacock, A. (2005). Dairy goat development in East Africa: A replicable model for smallholders. *Small Ruminant Research* Journal 77 (2): 225 - 238.

Pender, J., Nkonya, E., Jagger, P., Sserunkuuma, D. and Ssali, H. (2004). Strategies to increase agricultural productivity and reduce land degradation: Evidence from Uganda. *Agricultural Economics Journal*. 31(3): 181 - 195.

Perry, B., Randolph, T., Omore, A. and Vatta, A. (2005). *Improving the Health of Livestock Kept in Developing Countries.* In: *Livestock and Wealth Creation; (Edited by Owen, et al.),* National Resources International Limited; Nottingham University Press., UK. pp. 233 – 261.

Ragnard, O., Borchgrerink, A., Lazaro, E. and Temu, A. (2002). *Poverty reducing effect of agricultural development in Tanzania.* NORAGRIC report No 10 December 2002. Noragric Agricultural University of Norway 28pp. [http://www.nlhno/noragric/publications/report/NoragricRep10]site visited on 10/2/2008.

Randolf, T. F., Schelling, E., Grace, D., Nicholson, C. F., Leroy, J. L., Cole, D. C., Demment, M. W., Omore, A., Zinsstag, I. and Ruel, M.(2007). The role of livestock in human nutrition and health for poverty reduction in developing countries; *Journal of Animal Science (USA)* 85: 2788 - 2800.

Reaves, P. M. (1963). *Dairy Cattle Feeding and Management. 5th Edition.* John Wiley and sons, Inc., USA. 392pp.

Renkow, M. (2000). Poverty, productivity and production environment: A review of the evidence. *Journal of Food Policy* 25: 463 - 478.

Reynolds, L., Metz, T. and Kiptarus, J. (2000). Smallholder dairy production in Kenya. *Journal on Animal Production* 12: 66 - 73.

Riise, J. C. and McAinsh, C. V. (2001). Presentation of farmers' poultry school for small scale farmers rearing chickens under free- range and improved free range conditions. In: *Proceedings of the 28th Scientific Conference AICC*- Arusha 3rd- 5th December TSAP Conference Series 20-26pp.

Roberts, S. J. (1986). *Veternary Obstetrics and Genital Disease (Theriogenology).* Published by David Charles. Woodstock., United States of America. 981pp.

Rodgers, G. (1989). *Growth and Poverty in Rural Asia.* Sage Publications., New York. USA. 249pp.

Rugambwa, V. K., Mutagwaba, T. J. and Houterman, D. (1994). Economic contribution and the economics of smallholder dairy production in Kagera region, Tanzania. *In: Proceedings of the 21st Scientific Conference of Tanzania Society of Animal Production.* 21: 36 - 50.

Salem, B. N. and Smith, T. (2008). Feeding strategies to increase small ruminant production in dry environment: *Small Ruminant Research Journal* 77 (3): 174 - 194.

SDP, (2007). Smallholder Dairy Project. Cutting edge technologies to help Kenyan farmers break into export markets. *ILRI Journals: Report on facilitating e-consultation to fight poverty.* 12: 1 - 5.

Seppala, R. (1996). *The Politics of economic diversification: Reconceptualising the rural informal sector in Southeast Tanzania Report.* University of Dar-es-Salaam Press, Tanzania. 57pp.

Somda, J., Tollens, E. and Kamuanga, M. (2007). Transaction costs and the marketable surplus in smallholder farming systems of the Gambia. *Outlook on Agricultural Journal (UK).* 34(3): 189 - 195.

Sigot, A., Thrupp, L. A. and Green, J. (1995). *Gender and Natural Resources Management in Africa. Africa Centre for Technology Studies*. Nairobi Press., Kenya. 54pp.

Stotz, D. (1979). Smallholder dairy development in past, present and future in Kenya. Thesis for Award of PhD Degree of University of Hohenheim. S.A. 170pp.

Syrstad, O. (1995). Dairy cattle cross breeding in the tropics: The choice of cross breeding strategy. *Tropical Animal Health and Production Journal* 28(2): 223 - 229.

Tabatabai, H., Glombitza, K., Kowol, P., Macioszek, L., Othmer, R. and Simons, W. (1984). *Production and Marketing of milk in smallholder sector of the western region /Jamaica. Centre for advanced training in agricultural development. Institute of socio- economics and Agricultural development.* Technical University of Berlin., German. 30pp.

Thompson, E. F. (1997). Ruminant Research in the medium term plan of international Center for Livestock Research in dry areas (ICARDA). In: *Proceedings of the consultation on setting livestock Research priorities in West Asia and North Africa*. November 12th -16th Aleppo Syria 17-24pp.

Tripp, R. (2006). *Self Sufficient Agriculture: Labour and Knowledge in Small-scale Farming.* Cromwell Press., Trowbridge, United Kingdom.192pp.

Upton, M., Mbogoh, S., Rushton, T., Islam, S. and Mtenga, L. A. (2005). *Marketing to Promote Trade and Development.* In: *Livestock and Wealth Creation; (Edited by Owen, et al.),* National Resources International Limited; Nottingham University Press., UK. pp.127 – 144.

Urassa, J. K. (1999). Factors influencing milk output of dairy cattle under smallholder farms in Tanga region. Dissertation for Award of MSc Degree at Sokoine University of Agriculture, Morogoro, Tanzania. 131pp.

Urassa, J. K. and Raphael, E. (2006). The Contribution of small dairy farming to community welfare. A case study of Morogoro Municipality. [http://www.fiuc. Org/esap] site visited on 25/ 01/ 2007.

URT, (2001). United Republic of Tanzania. *Agricultural Sector Development Strategy (ASDS).* Agricultural Sector Lead Ministries (ASLM's); Government Printers, Dar-es-Salaam, Tanzania. 82pp.

URT, (2003). United Republic of Tanzania. *Poverty Reduction Strategy, The Second Progress Report.* Government Printers, Dar-es Salaam, Tanzania. 23pp.

URT, (2005). United Republic of Tanzania: *Integration of Population Variables in Development Planning. Part II.Trainees Manual.* Demographic Training Unit, University of Dar-es- Salaam. Population Strategy Programme. 67pp.

URT, (2006a).United Republic of Tanzania: *National Livestock Policy;* Ministry of Livestock Development; Government Printers, 81pp.

URT, (2006b) United Republic of Tanzania. *Agricultural Sector Development Programme (ASDP):* Support through basket fund; Government Programme Document. 103pp.

URT, (2006c). United Republic of Tanzania. *Socio-economic Profile Tabora region. National Bureau of Statistics:* Ministry of Planning, Economy and Empowerment, Region and District projections; Tabora Region. Volume 12: 11-69.

URT, (2007a). Local Authority Accounting Committee (LAAC) *Taarifa ya Utekelezaji Maagizo ya Kamati ya Bunge ya Hesabu za Serikali za Mitaa (LAAC)*. Igunga District. May 2007.

URT, (2007b). United Republic of Tanzania. *National Sample Census of Agriculture 2002/03*. *Tanzania Agriculture Sample Census;* Volume Vn. Regional Report: Tabora region. 303pp.

Van Dam, B. P., Bartlett, P. C., Kirk, J. H. and Mather E. C. (2008). The effect of age at first calving on reproduction, milk production and disease incidence in the first lactation of first dairy heifers. *Theriogenology Journal*. 30(3): 583 – 591.

Wattiaux, M. A. (2004). Managing reproductive efficiency. Babcock Insititute of International Dairy Research and Development University of Wisconsin – Madson Dairy Essentials. [http://www.babcock.cals.wisc.ed/] site visited on11/6/2008.

Williamson, G. and Payne, W. (1978). *An Introduction to Animal Husbandry in the Tropics 3rd Edition.* Longman Group (FE) Ltd., Printed in Hong Kong. 278pp.

World Bank (2001). *Attacking poverty overview. World Bank Development reports 2000/01*. Washington DC., USA. 15pp

Yoshida, Y. (1999). Market Information Services for Perishable Farm Products: *Report on Collection and Analysis of Market Information for Farm Products in Asia.* 73pp.

APPENDICES

Questionnaire no……..

Appendix 1: Questionnaire for dairy cattle owner

Name of respondent…….
Village ……..
Ward …….
Division…….
Date ……..

A. Background Information

Please tick ( ), circle and or fill where appropriate

1) What is your age ……..(Years)

2) Gender of the respondents 1. (M) 2. (F)

3) Marital status
   1. Single
   2. Married
   3. Widowed
   4. Divorced

4) What is your education level?
   1. No formal education
   2. Adult education
   3. Primary education
   4. Secondary education
   5. Post secondary education
   6. Others (specify) ……..

5) Family size and dependents

Family size ……

Category	Male	Female
Household head		
Dependants:		
Adults		
Children / Young		
Total		

6) Major occupation of a household head …….

B. Different sources of income (social- economic status of a household)

7) What are your annual major economic activities and estimated income (Tshs)

S/n	Activities	Estimated income per year (Tshs)
1		
2		
3		
4		
5		
	Total	

C. Dairy cattle performance

8. When did you joined dairy cattle activities……

9. How many dairy cattle do you have now?
State no ……. Classes: cows…… bulls……
Young bulls…… Young heifers…….
Bull calves…….. heifer calves ……

Dairy cattle performance and production

10) Cow no **1**……..
Breed …….
1st calving age ……..months ……
Birth date…….
Calving interval…….

Parity	Mating system	Year calved	M/F calf	Average milk produced (litres)	Lactation lengths (months)	Dry periods (months	Average price of milk (Tshs)	Total income from milk (Tshs)	Action taken to calf

Bull used for mating
1. Owning a bull 2. Hired bull 3. Obtained as an in calf 4. Owning and hired a bull

11) Cow no **2**……..
Breed …….
1st calving age ……..months ……

Birth date…….
Calving interval…….

Parity	Mating system	Year calved	M/F calf	Average milk produced (litres)	Lactation lengths (months)	Dry periods (months)	Average price of milk (Tshs)	Total income from milk (Tshs)	Action taken to calf

12) How many animals have died from the time you first obtain your cow……. (.mention)

S/n	Year	Age at death	Reason (s) of death

13) How much milk is produced per day …… (litres)

14) How much milk do you sell per day…….. (Litres); ……litres per lactation

15) Amount of milk consumed ……..litres per day.

16) What was your annual income before joining dairy activities?..... (Tshs)

17) Annual income from dairy enterprises ……..(Tshs)

18) What is your total annual income after joining dairy activities ……(Tshs)

19) At what age did your cow calved for the first time ……. (Months)

D. Access to milk marketing

20) Where do you sell your milk ……

21) How far from the place you are living ……. (Km)

22) To whom do you sell your milk and at what price?

S/n	Milk sold to	Price (Tshs) per litre
1	Neighbours	
2	Mama lishe (Food vendors)	
3	Kiosk owners	
4	Middlemen	
5	Others (Specify)	

23) Comment on the price of milk ……

24) How do you transport your milk? 1. By Bicycle 2. On foot 3. Buyers collect themselves

25) How much do you pay for transporting your milk? …….(Tshs)

26) Comment on the size of your market
1. Large 2. Moderate 3. Relatively small 4. Others (do not know)

27) How do you receive your payment after selling milk?
1. Daily pay 2. Weekly 3. After two weeks 4. Monthly.

28) Comment on the number of milk producers……
……..

29) What are your personal comments regarding the introduction of the dairy enterprises…….
…….

30) What structure/ any assets have you acquired and the estimated value through revenue accrued from the dairy enterprises

Item	Estimated value
……	……
……	…….
…….	……

31) Type of house (s) owned by the household

S/n	Type of house	Wall materials used	Roofing materials

32) Do you have children who are attending school? 1. Yes 2. No. If No, go to Qn no 34

33) If yes, how much do you spend for paying school fees per student per year

S/n	Level of school/ college	No of children	Amount spent per year (Tshs)

34) Do you have an access to health services?
1. Yes 2. No

35) Are you a member of Community Health Fund (CHF?)
1. Yes 2. No

36) Can you estimate how much you spend on health services per year?.....
37) How much do you spend on food per month? .....; = …….per year
38) State an estimated income from other species in a year

Livestock category	Number	Estimated income (Tshs)

39) What are the major expenditures of the income obtained from milk?
……
…….
……..
40) Do you get extension services? 1. Yes 2. No
If yes, who provides those services ……

41) How do you grade the extension services provided?
……
42) List the resources owned by a household
…….
……
43) Who decides on how much to spend on income obtained?
……...

44) Do you have any access to credit facilities?
1. Yes 2. No

45) What are the constraints encountered in your project (List them)
…….
……
……..

E. Dairy - crop production integration

46) Is there any revenue from milk used in crop production? 1. Yes 2. No
If yes, how much…… for which purposes…….

47) How is cattle manure used? …….

48) If manure is used for crop production, have you observed any changes in yield?
1. Yes 2. No

Crop	Before applying cattle manure	After use of cattle manure

49) Is there any reduction in mineral fertilizer use because of use cattle manure?
1. Yes 2. No

50) Do you use crop residues to feed your animals? 1. Yes 2. No

51) How do you obtain those residues……..
a. Purchase
b. Exchange with other commodities
c. From own farm
d. Freely obtained

52) Can you estimate how much do you spend if purchased……..

Appendix 2: Questionnaire for non dairy cattle owner

Name of respondent…….
Village ……..
Ward …….
Division…….
Date ……..

D. Background Information
Please tick ( ), circle and or fill where appropriate

4) What is your age ……..(Years)

5) Gender of the respondents 1. (M) 2. (F)

6) Marital status
   1. Single
   2. Married
   3. Widowed
   4. Divorced

4) What is your education level?
   1. No formal education
   2. Adult education
   3. Primary education
   4. Secondary education
   5. Post secondary education
   6. Others (specify) ……..

5) Family size and dependents
   Family size ……

Category	Male	Female
Household head		
Dependants:		
Adults		
Children / Young		
Total		

6) Major occupation of a household head …….

B. Social- economic status of a household)
7) What are your annual major economic activities and estimated income (Tshs)

S/n	Activities	Estimated income per year (Tshs)
1		
2		
3		
4		
5		
	Total	

C. Other livestock species

8) Do you keep livestock? 1. Yes 2. No If no go to question no 9.

An estimated annual income from other livestock species

Livestock category	No of animals	Average price per animal	Annual income (Tshs)

9) What assets do you have from your own enterprises? (List them)

Assets	Estimated value
…….	…….
…….	……...
…….	……

10) Type of house (s) owned by the household

S/n	Type of house	Wall materials used	Roofing materials

11) Do you have children who are attending school? 1. Yes 2. No (Tick) If No, go to No 14

12) If Yes, how much do you spend for paying school fees per student per year……

S/n	Level of school/ college	No of children	Amount spent (Tshs) per year

13) Do you have an access to health services?
1. Yes 2. No

14) Are you a member of Community Health Fund CHF)?
1. Yes 2. No

15) How much do you spend on health services per year?.....

16) How much do you spend for food per year ……

D. Dairy activities

17) Are you aware of the existence of dairy activities in your village?
1. Yes 2. No
18) If Yes, why are you not a members of the project (mention)
……..
……..
……
19) Would you like to join the project?
1. Yes 2. No
20) If yes, Why? …… ……
…….
……..
21) If No, Why? ……
……..
……
22) Do you use farm yard manure in crop production 1. Yes 2. No

23) How do you obtain it …….1. Freely obtained 2.Purchase

24) If obtained through purchase, is there any cost incurred 1. Yes 2. No

25) If yes, how much ……..

26) If manure is used for crop production, have you observed changes in yield?

Crop	Before applying cattle manure	After use of manure

27) Is there any reduction in mineral fertilizer because of the use of cattle manure?
1. Yes 2. No

28) Do you use crop residues to feed your/ others animals?
1. Yes 2. No

29) Estimate income obtained from selling crop residues since you do not keep animals ……

Thank you for your cooperation

Questionnaire no……

Appendix 3: Questionnaire for district officials and donors

Project name…….
Respondents name……
Position …….
Date …….

General information
1) Age of the respondent…….
2) Gender of the respondents……..
1. Male 2. Female
3) Highest professional qualification reached ……..
4) When did the project start…….
5) What criteria have been used in selecting members of the project?
……..
…….
…….
6) Did you involve the community in project planning?
1. Yes 2. No

7) What was the planned term of the project (……..)
1. Short term
2. Medium term
3. Long term
8) What were the project objectives
…….
…….
…….
9) Did the project objectives address the needs and priorities of the communities?

1. Yes 2. No
10) If yes, which priorities were addressed?
……..
……
……
11) How do the beneficiaries perceive with respect to the ownership of the project?
1. Theirs
2. Government's
3. NGO's /FBO's

12) Is there any village committee that is involved in dairy project?
1. Yes 2. No

13) Where do milk producers sell their milk? …….

14) Are there any successes of the project? 1. Yes 2. No
15) If yes, what are the indicators?
……..
……

16) What are the constraints encounted during project implementation?

……..
……
……
……

17) What are your strategies to ensure that milk producers attain high standard of milk production and markets

……
……
……
……

18) What are your comments towards dairy activities?

……
……
……
……

19) How do you relate milk production from the project and from the local herd?

……
……
……..
……

Thank you for your cooperation.